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XXXIII.

TREATMENT OF MULTIPLE PAPILLOMAS OF THE
LARYNX IN CHILDREN.*

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The treatment of multiple papillomas of the larynx in children has always been difficult because of the tendency to recurrence. Many methods have been employed, such as tracheotomy, thyrotomy and cautery, endoscopic operative measures, fulguration, the application of various medicines locally, and X-ray and radium. The lack of uniformity of methods employed in the treatment of this condition emphasizes the fact that results have not always been good. During the last six years I have treated the condition by radium inside

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the larynx and the outside of the neck, and the results have been much more satisfactory than with any previous methods.

In 1901, McKenzie established the fact that in many cases multiple papillomas of the larynx in children disappear of themselves if a tracheotomy is performed; he advocated tracheotomy instead of treating the papillomas. Clark, in 1905, and Smith, in 1914, stated that they believed tracheotomy to be the most efficient method of treating these cases. While the value of tracheotomy is well known, cases are reported in which the patients have worn tubes for years without any improvement of the condition. I examined a woman, aged 22, who had worn a tracheotomy tube since she was two and her larynx was filled with papillomas. Polyak, in 1911, discussed the treatment of three patients by radium, two adults and one child. He believes that radium will take the place of operative measures in these cases. Abbe, in 1898, was the first in this country to treat multiple papillomas of the larynx with radium. The patient was a woman aged 30. In 1912 he treated a girl aged 16 with papillomas of the larynx with complete clearing up of the condition. Harris, in 1913 and 1914, reported thirteen collected cases which included Abbe's, Polyak's, and Freudenthal's cases. Cohen told of a child aged 5, treated by Bernham, in whom the results were exceedingly good. Plum, in 1920, reported sixteen cases of multiple papillomas; four of the patients were treated by radium, two with good results, and one with a fair result. Plum believes that the results are encouraging. Several observers report poor results by the use of radium. Hopkins, in 1914, reported a case in which radium was used, and was followed by adhesions of the anterior three-fourths of the larynx, and brought up the question of whether or not the scarring was due to the radium treatment. Iglauer, in discussing Smith's article, spoke of the scarring in the larynx following the treatment by 50 mg. radium for seven or eight hours. Jones reported a case of multiple papillomas unsuccessfully treated with radium, but the dosage was not given. Duffey, in 1919, reported a case of a child, aged 3, who developed diffuse thyroiditis and died, following the application of radium inside and outside the larynx. Lynch has perfected the suspension apparatus that is now used and which has added a great deal to the efficient

care of these patients. His results in removing the papillomas by operative measures have been superior to any others on record in this country. He, however, now believes that the dissection of multiple papillomas from the larynx is an unsuccessful procedure and that the best method for treating these conditions is by fulguration or by acid nitrate of mercury.

During the years from 1914 to 1920, I have examined at the Mayo Clinic twenty-six children under 12 with multiple papillomas of the larynx. The youngest child was ten months; and the oldest was twelve years. Such patients are usually brought to the Clinic because of hoarseness and shortness of breath, which may have started at the age of two or three months, as a slight wheezing or crowing cough, or the condition may not have been noticed until the child began to talk. Sometimes the first symptoms are not observed until the child is three or four years of age. He may later become unable to speak above a whisper, and may get blue when crying and require emergency tracheotomy. Frequently parents state that the hoarseness came on after whooping-cough, measles, or a cold, which they believe is the cause of the trouble.

Multiple papillomas of the larynx are often diagnosed as laryngismus, stridulus, asthma, and enlarged thymus, but these conditions are readily ruled out by careful history taking. The diagnosis can be made only by laryngoscopic examination, by means of which the typical picture is seen.

Many of the patients in my series had been operated on by endoscopic methods. One patient had had six thyrotomies and cauteries performed by a general surgeon and was wearing a tracheotomy tube. The glottis was so badly scarred that a small probe only could be passed through it. One patient had had six suspensions and the removal of the papillomas, but when he came to the Clinic a large papillomatous mass stood up from the larynx and almost filled the laryngopharynx. The upper margin of the mass was on a level with the tip of the uvula. The conditions of the other patients were not unusual; the larynx was usually filled with a varying amount of papillomatous tissue. Nineteen of the patients had had tracheotomies previously or tracheotomy was performed for marked dyspnea shortly after their arrival. Tracheotomy was not performed unless obstruction made it necessary. One

patient not included in the group of twenty-six died on the train coming to Rochester from laryngeal obstruction (Fig. 1).

TREATMENT.

The treatment in this series of cases was given under ether, by means of a Lynch suspension apparatus. Except in a few of the early cases no attempt was made to remove the papillomas. A small tube, containing the emanations or the radium salt, was inserted into the glottis and held there by means of forceps. The tube was kept moving under direct observation so that no particular area was overtreated and so that the part needing treatment received it (Fig. 2). The patient was kept asleep during the entire treatment, and from 75 mg. to 150 mg., or millicuries, of radium were used for from twenty minutes to thirty-five minutes, and occasionally longer if indicated by the particular condition. No screening was used except the silver tube which contained the salt, or the emanation, and is less than 1 mm. thick. Patients were treated, as a rule, about once in six weeks or two months. If recurrence was noted, further treatment was given before the recurrence became marked. Parents are always told that unless the child can be brought back at definite intervals it is of little use to begin treatment. The most suspensions given in one case were six, and the least one. Besides these suspension treatments, radium was applied outside the larynx; as a rule about 3,000 mg. hours were given, using 2.5 cm. of wood and 2 mm. of lead screening. These external applications were frequently given between the suspension treatments.

RESULTS.

Of the twenty-six cases, nine cannot be considered in the results. One patient died about twelve hours after an emergency tracheotomy. One patient died at home between treatments for the want of a tracheotomy, after having had dyspnea for a week. Four patients did not remain for treatment since they could not return at definite intervals. Two patients received one or two treatments and were unable to return. One patient could not be traced, but at the last examination was remarkably improved.

Of the seventeen patients of whom definite information was obtained, eleven are entirely free from papillomas; nine of these had had tracheotomies and the tracheotomy tube had been removed. The tube is always left in place at least six months after the larynx is free from papillomas. One child, on whom a tracheotomy was performed at the age of two and one-half years, had worn the tube for one year and seven months and it could not be removed after the larynx was entirely free from papillomas because of the apparent collapse of the trachea above the tracheotomy opening. A two-way tube was inserted in place of the old tube, and later this was removed, and the tracheal opening closed. This was the only instance in which any difficulty occurred in removing the tracheotomy tube. Two of the eleven patients did not have tracheotomies and were not suspended; they received treatment entirely outside the larynx because they had colds at the time of their examination and it was thought inadvisable to give ether. Six of the seventeen patients are still under treatment, but five during the last year only. The larynx of four of the six patients is almost entirely cleared up; possibly there may be an occasional papilloma, but the voice is fairly good. Three of these four had tracheotomies and they can cork their tracheotomy tube. One of the six is much improved but papillomas are present and the voice is hoarse. This patient is wearing a tracheotomy tube and can cork it. One of the six patients, the one referred to as having had so much operative work before coming to the Clinic, is so remarkably improved that the papillomatous mass is now intralaryngeal. In the entire group I have not seen any bad results follow the use of radium, but I believe that this is undoubtedly owing to the fact the radium was under direct observation and was kept moving while in the glottis (Fig. 3).

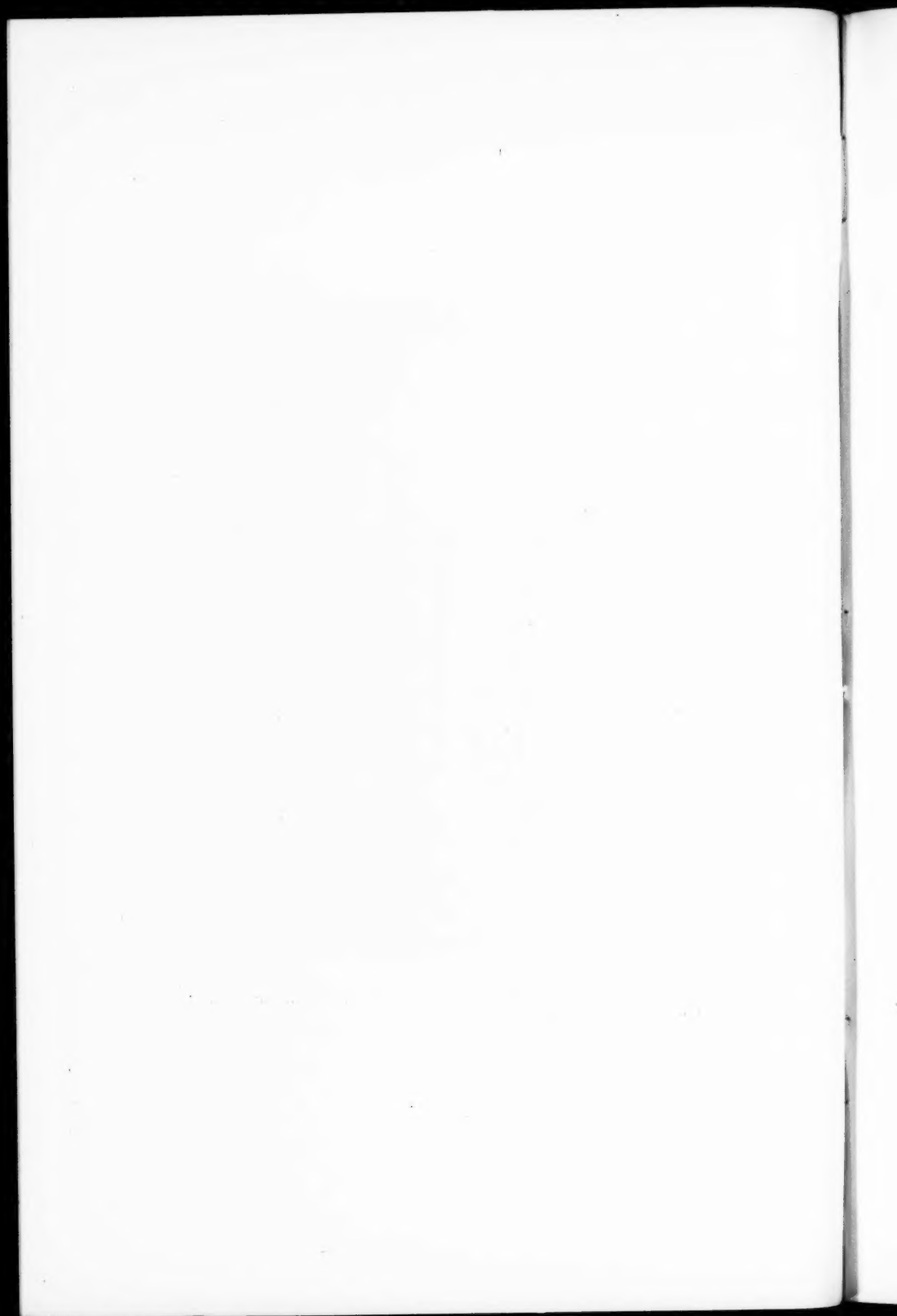
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Fig. 1. Specimen taken at necropsy of a multiple papilloma of the larynx in a child who died on the train on the way to Rochester for an examination.



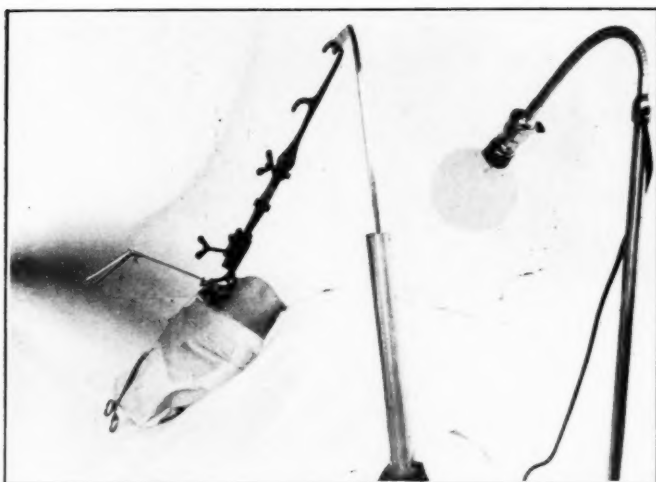
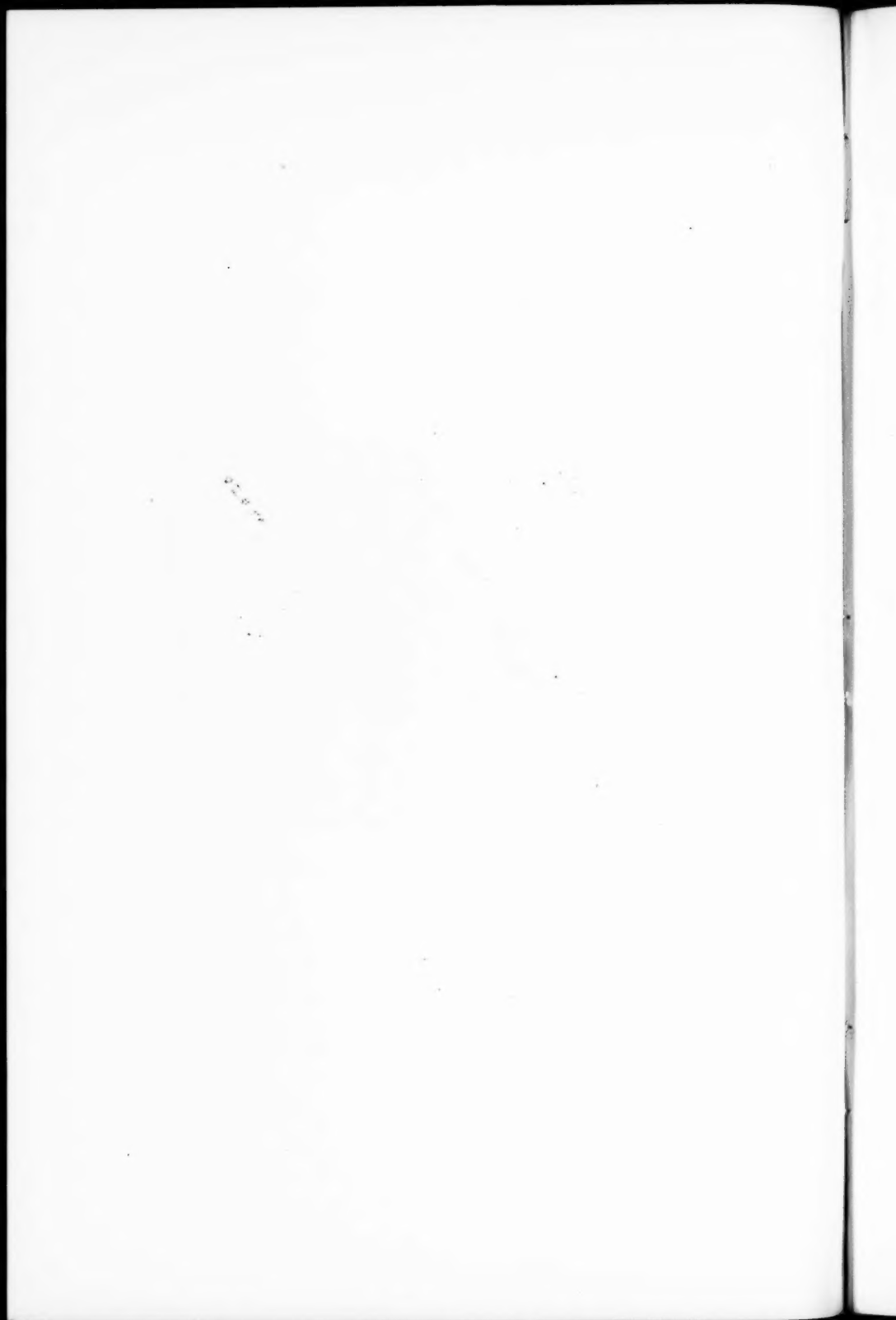


Fig. 2. A child under suspension. The forceps in the mouth holds a tube of radium directly in the glottis. The radium tube is kept moving during the application.



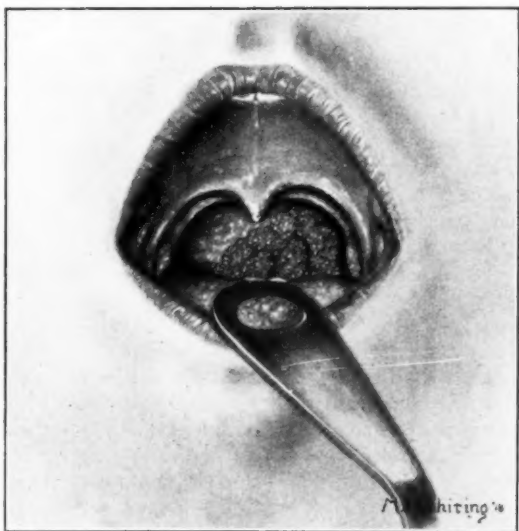
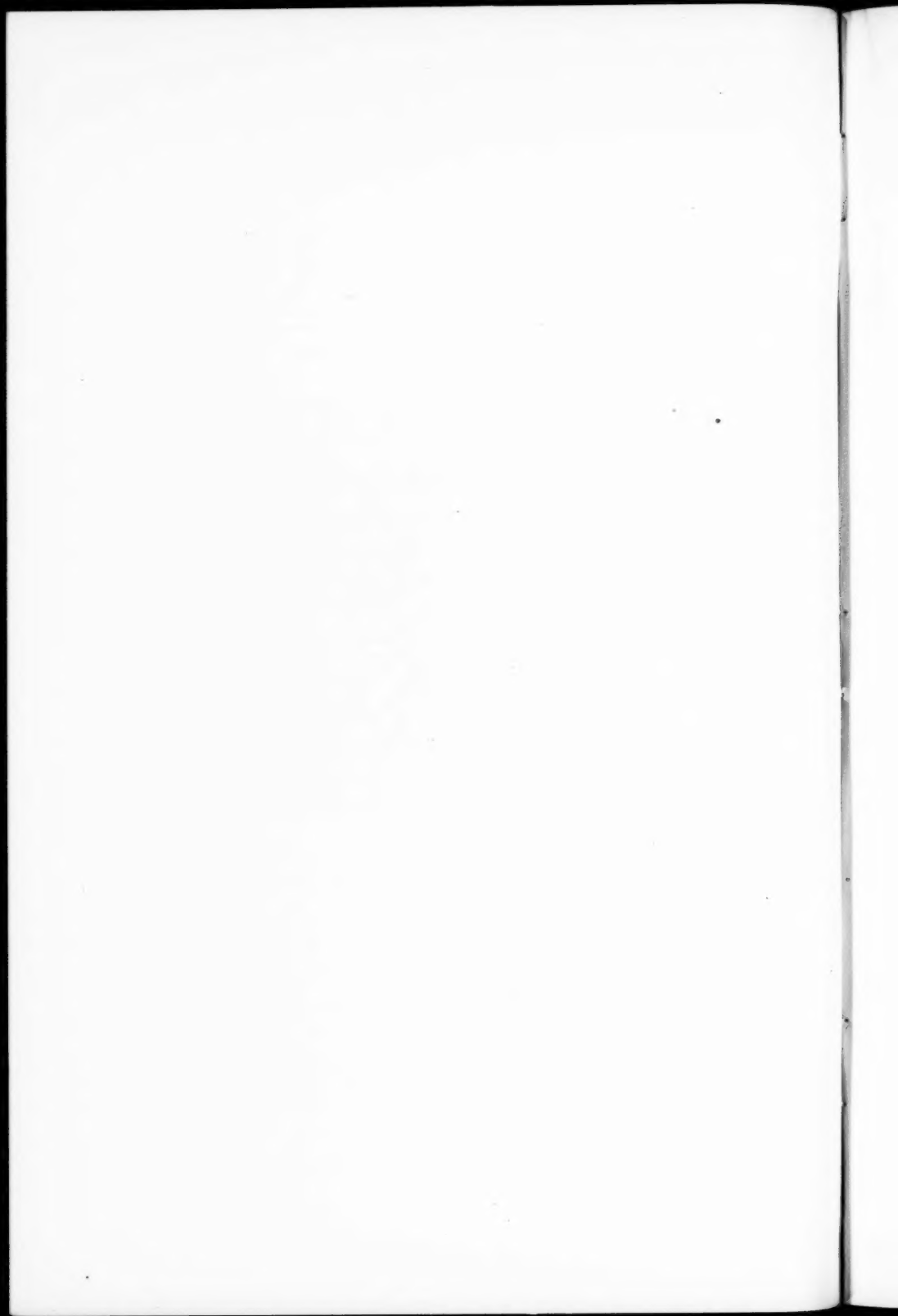


Fig. 3. An extensive papilloma of the larynx which has extended up into the pharynx from the glottis, the result of repeated operative treatment. The condition has now almost entirely disappeared under radium treatment.



XXXIV.

THE ENDONASAL OPERATION OF THE LACRIMAL SAC.

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In 1917, the writer had the honor to present a paper on the foregoing subject before the section on ophthalmology of the American Medical Association, reporting at that time some eight cases, with one failure. Since that time ten cases have been operated upon, with no failures, as far as restoration of physiologic function was concerned, though not all were free from pus. As in the previous series, secondary operations were performed on three cases. Such a series is not large in number, but is sufficient from which to draw certain conclusions.

Anatomy.—A detailed description of the anatomy of the canaliculus, sac and duct may be gained from the better textbooks. To those less familiar with the anatomy the accompanying illustrations may be helpful. The anatomic essentials, from a point of view of disturbance of function, are that the passageway for the tears presents two constrictions, one where the sac joins the duct and another where the duct enters the nose. This latter constriction is increased by the presence of a distinct valve, the so-called valve of Heister.

Indications.—Briefly, the endonasal operation may be said to be indicated whenever the normal passageway for the tears has become obstructed, and the ordinary conservative measures for restoration, such as probing and irrigation, have been unsuccessful.

External Operation.—This operation, revived by Berlin in 1863 and subsequently by Toti in 1904, presents certain decided disadvantages. The external operation, even if successful in so far as the cure of the abscess was concerned, did not cure the epiphora. This condition so annoyed and inconvenienced the patient that the subsequent removal of the gland became necessary. The resulting scar and its subsequent contracture

was frequently unsightly. Occasionally, too, a fistula remained. These disadvantages prompted West in 1908 to attempt the operation from within the nose, rather than from without, and to thus restore the normal and physiologic drainage into the nasal cavity.

Endonasal Operation.—The advantages of this over the previous methods, to quote from West, are as follows:

"1. The physiologic function of the path for the tears is again restored, so that not only a suppuration of the sac, a lacrimal fistula or a phlegmon is healed, but also the tears flow normally through the nose. A later epiphora is accordingly avoided.

"2. A so-called cure by probing is rendered unnecessary.

"3. The lacrimal gland is spared.

"4. A skin incision or a curetting from without, with eventual scar foundation, is avoided."

The disadvantages seem to be two only. Certain persons, it is true, by sharply blowing the nose, can force air out through the canaliculus. This objection would seem to be theoretical rather than practical, as West asserts that this condition was never complained of by his patients.

My attention has been called to another disadvantage by Dr. William E. Bruner, by whom most of my cases have been referred. In certain cases where there was a complete restoration of physiologic function, it was still possible to express slight traces of pus through the punctum on milking the sac. Such a condition would of course render a cataract operation impossible, on account of the danger of infection.

Operation.—The most popular methods of operation at the present time are four—those of West, Yankauer and Mosher, and more recently the operation of Wiener and Sauer, reported and described by them before the last meeting of the section on ophthalmology of the American Medical Association. The operation of Yankauer I have performed on the cadaver and once upon the living. It is both ingenious and difficult. The objection would seem to be that it confines itself rather to the duct than the sac, in an endeavor to restore the passageway into the inferior meatus. It seems to carry too great a danger of subsequent stenosis at the junction of the sac and duct.

The operation of Mosher I have performed only on the cadaver. With the operation of Sauer and Wiener I am not familiar.

My operation of choice is that of West, with slight modifications, too unimportant to possess any merit as to originality. After preliminary cocaineization and infiltration of $\frac{1}{2}$ per cent novocain, to the dram of which two minims of adrenalin have been added, a three sided incision is made. The first two incisions are parallel with the floor of the nose and extend as far forward as possible from two points, the upper from the point of attachment of the middle turbinal and the lower from a point opposite the free border of the middle turbinal. For these incisions the right angled knife of Freer is exceedingly well adapted. The anterior ends of these incisions are then joined by a vertical incision made as far forward as possible and carried well down to the bone. This flap is now elevated submucously, the periosteum being of course included, and is deflected backward, as on a hinge, between the middle turbinal and the septum, where it is held out of the field during the remainder of the operation by a small pledget of cotton. The posterior lip of the dense ascending process of the superior maxilla is now attacked with chisel and gouge until the nasal wall of the sac is presented to view. This is easily recognized by palpation with a probe. Sufficient bone should be removed to uncover the sac freely in almost its entire nasal aspect. At this point I have found it of advantage to insert a probe through the canaliculus into the sac, thus pushing its nasal surface, tentlike, well over toward the septum. A thin scalpel is then inserted between the probe and the lateral nasal wall, the outer or free end of the probe being held by an assistant or fastened to the forehead by a strip of adhesive. By so doing it is possible to resect a larger portion of the sac. Loose pieces may subsequently be removed by means of the smallest sized forceps of Gruenwald. West's dictum, that at the completion of the operation the probe introduced through the canaliculus into the sac must pass horizontally into the nose should be strictly adhered to. The submucous flap is now replaced, its upper half covering the sac resected and the lower portion held in position for twenty-four hours by light packing. Subsequently the nose should be kept free from

crusts until healing takes place. If desired, the sac may be irrigated through the canaliculus. I have not always found it necessary. I have sometimes wondered if the replacement of the lower portion of the flap might not be dispensed with.

My results from this operation, as far as restorations of the physiologic pathway is concerned, have been uniformly good. As before mentioned, it has occasionally been possible to express a slight amount of pus from the canaliculus. So far I have not operated upon any cases of acute abscess. West has performed this operation on all possible types of cases and in 1913 reported 130 operations with 90 per cent of cures.

One of my most interesting cases was a fourth year medical student, who had suffered from suppuration of the sac and constant epiphora. He had developed a habit spasm and would unconsciously squeeze out the secretion from the sac every few minutes during his waking hours. Subsequent to the operation this habit disappeared.

Difficulties.—That the endonasal operation presents certain decided technical difficulties is undoubtedly true. My feeling is that it is performed by comparatively few rhinologists for two reasons: (1) On account of the fancied difficulty, and (2) because of the unwillingness of the ophthalmologist to refer appropriate cases. As regards the first, the operation, to my mind, is no more difficult than the average submucous resection. The operation should be performed at first upon the cadaver until a proper technic is attained. As regards the second, the operation is, or should be, an example of team work on the part of the ophthalmologist and rhinologist, just as the correction of mouth breathing is, in many cases, the result of team work on the part of the rhinologist and orthodontist. Each is essential to the success of the other. Fortunately, the man who embraces all four specialties in his domain is becoming the exception, rather than the rule, so it is only by the courtesy of the ophthalmologist that the rhinologist may obtain cases.

The purpose of this paper is not to describe any original technic, but to present a record of my own successes and failures, in the hope of stimulating interest in an operation which may bring relief to many and which, it would seem, should have a wider popularity than it at present enjoys.

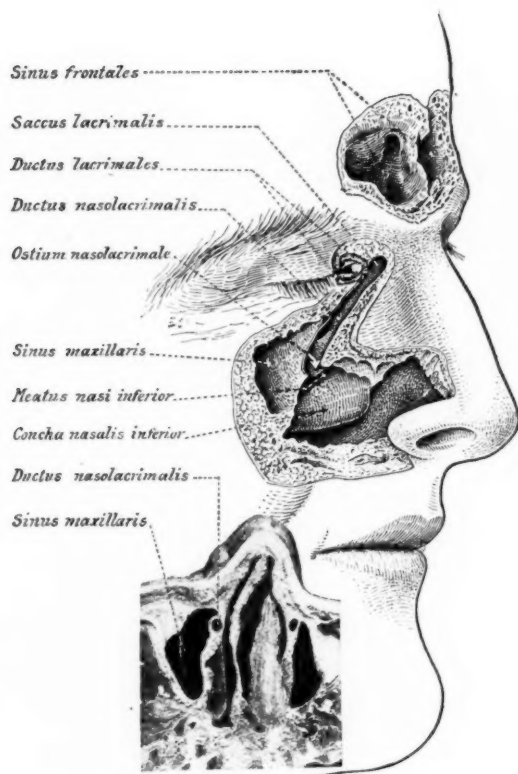


Fig. 1. A dissection showing the nasolacrimal passageways and the relations of the nasolacrimal duct to the maxillary sinus and the inferior nasal meatus. The inset is a transection of the nasal fossae, the maxillary sinuses and the nasolacrimal ducts. By courtesy of P. Blakiston & Co. Schaeffer: The Nose and Olfactory Organ.

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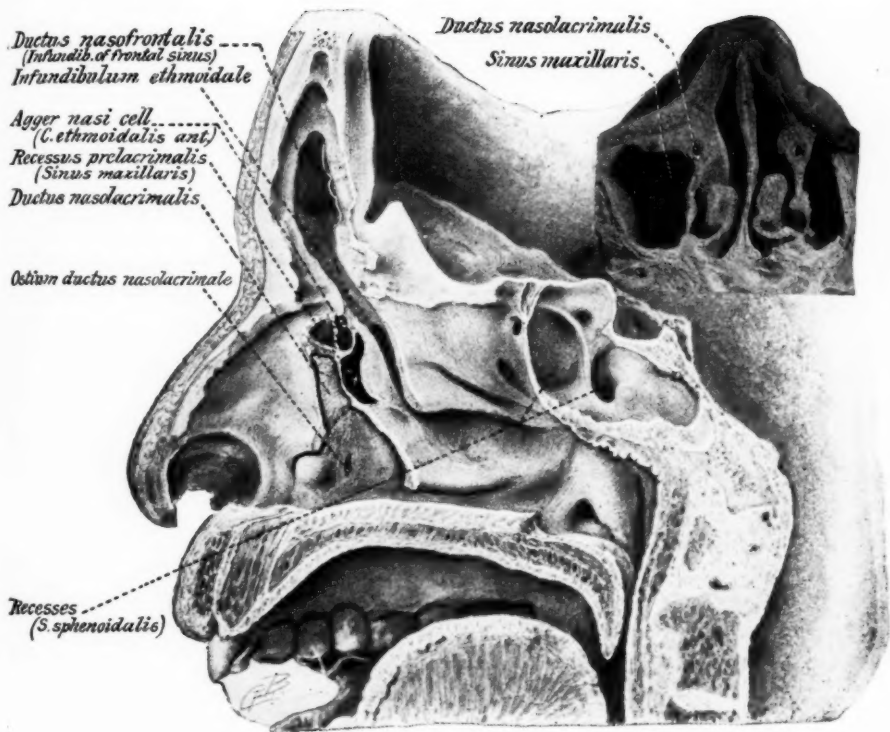
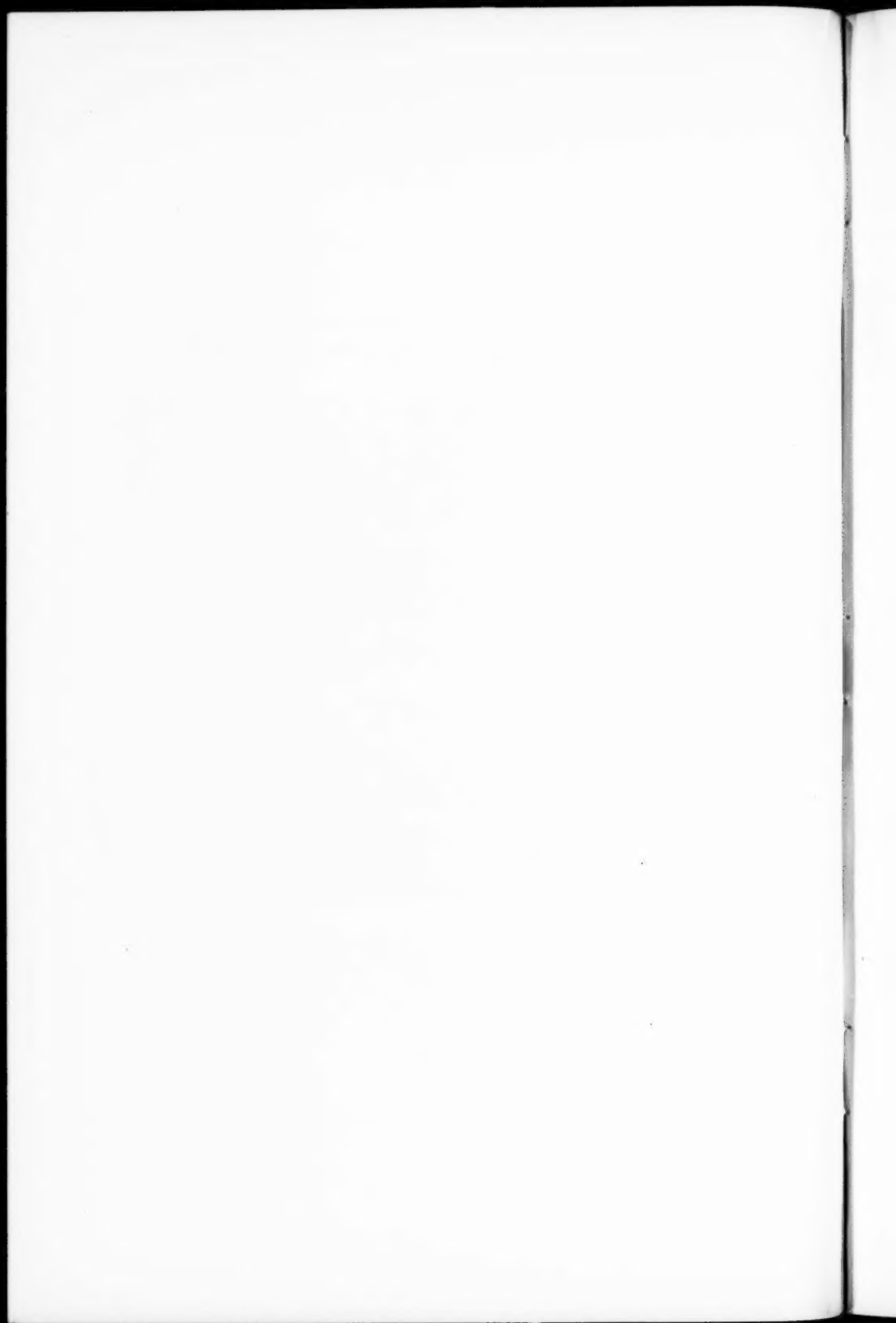


Fig. 2. A dissection of the lateral nasal wall with especial reference to the nasolacrimal sac (indicated by dotted outline in white), the agger cell, the prelacrimal recess of the sinus maxillaris. The insert is a transection showing the relations of the nasolacrimal duct. By courtesy of P. Blakiston's Son & Co. Schaeffer: The Nose and Olfactory Organ.



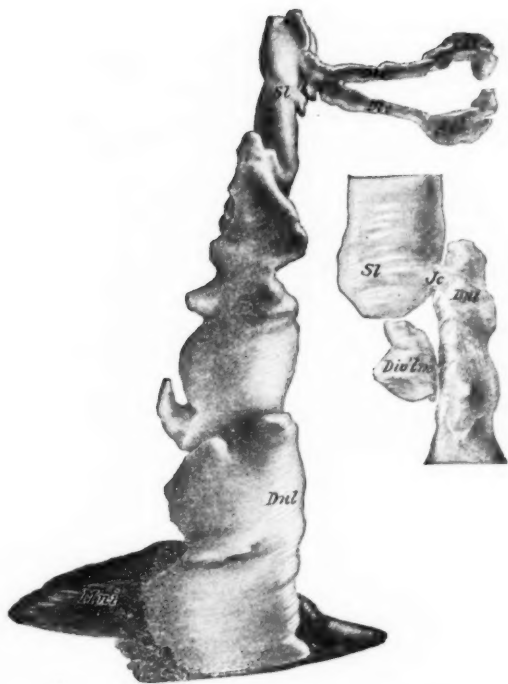


Fig. 3. Reconstruction of the nasolacrimal passageways of an adult aged 65 years; medial view. Especially note the irregularity and the diverticula of the nasolacrimal duct. The insert shows the details of the side to side union of the lacrimal sac and the nasolacrimal duct; moreover, illustrates the large bud-like diverticulum from the nasolacrimal duct. By courtesy of P. Blakiston's Son & Co. Schaeffer: The Nose and Olfactory Organ.

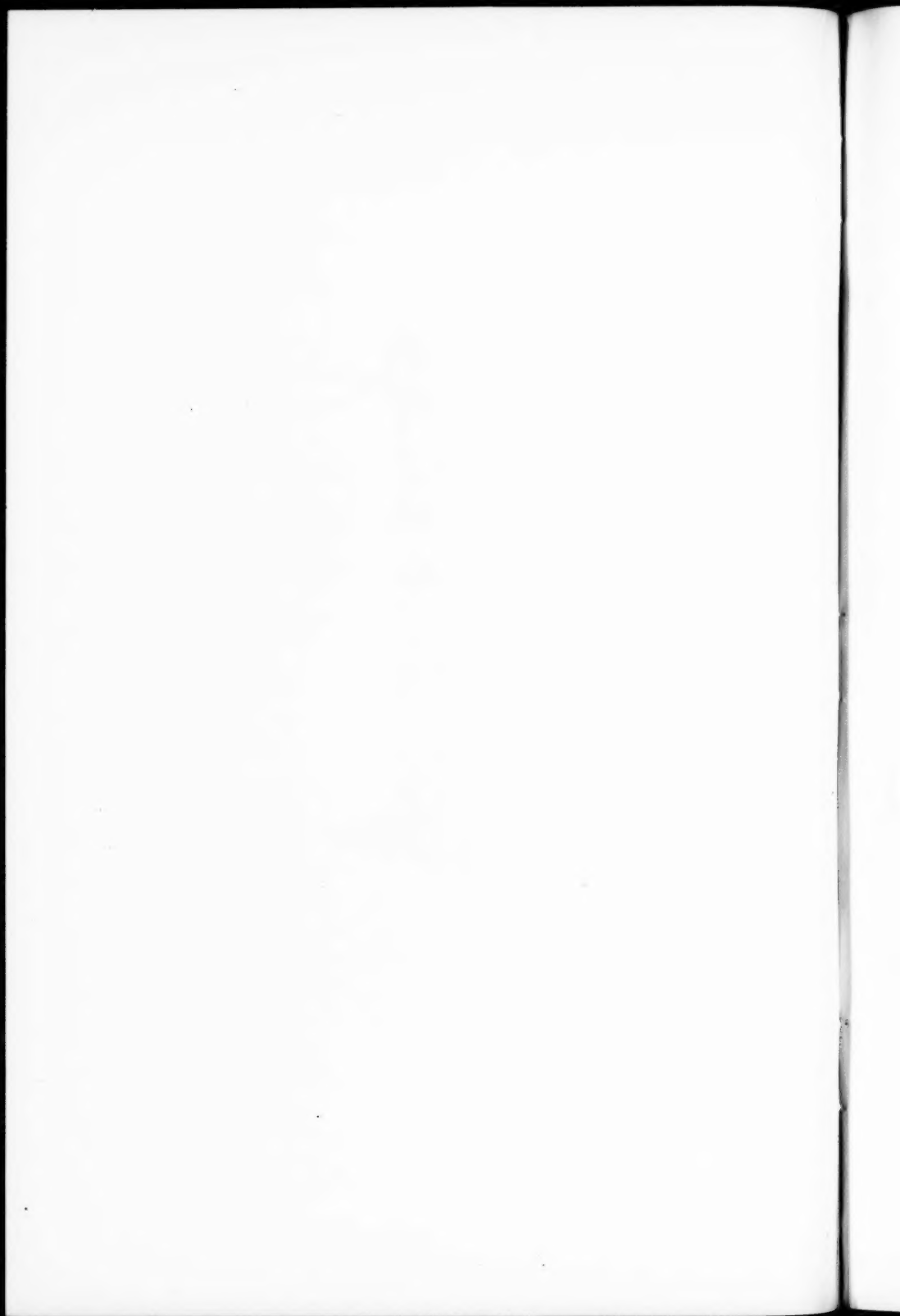




Fig. 4. Reconstruction of the nasolacrimal passageways of an adult aged 65 years; lateral view. By courtesy of P. Blakiston Son & Co. Schaeffer: The Nose and Olfactory Organ.

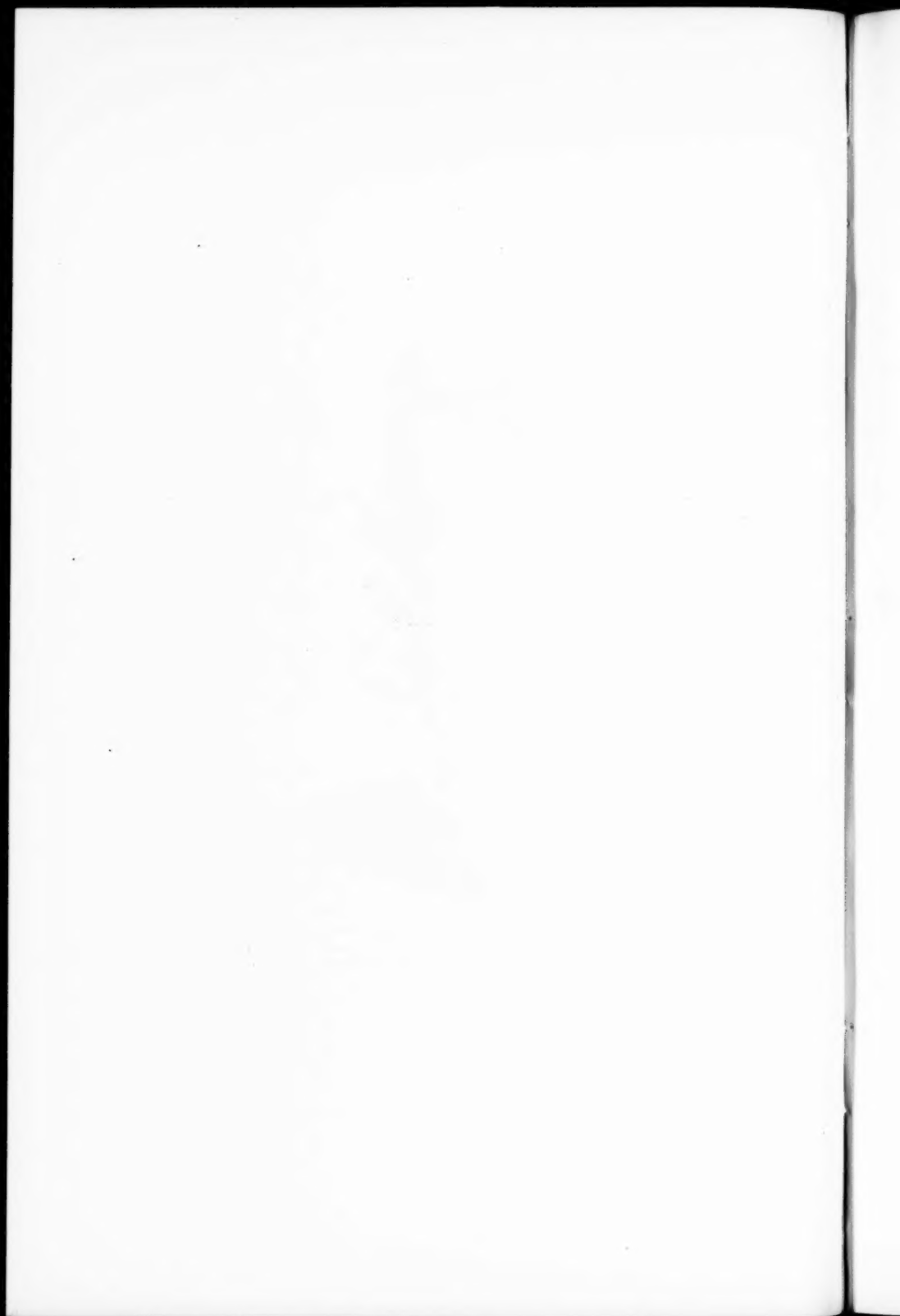


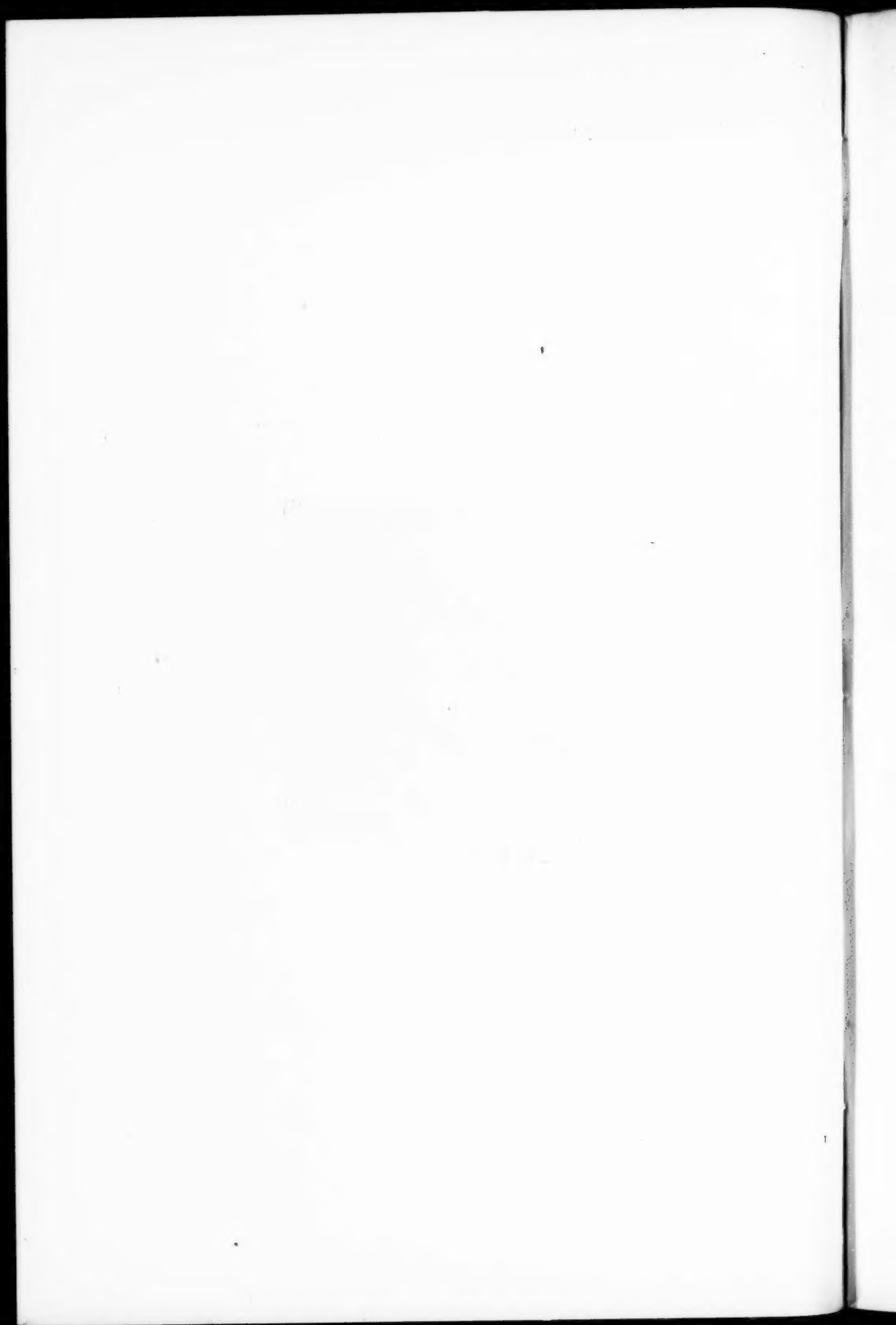


Fig. 5. Reconstruction of the nasolacrimal passageways of an adult aged 60 years. Note the regularity of the nasal duct and the gradual mergence of the lacrimal sac into the nasolacrimal duct at the constriction of the isthmus. By courtesy of P. Blakiston's Son & So. Schaeffer: The Nose and Olfactory Organ.





Fig. 6. Finished operation.



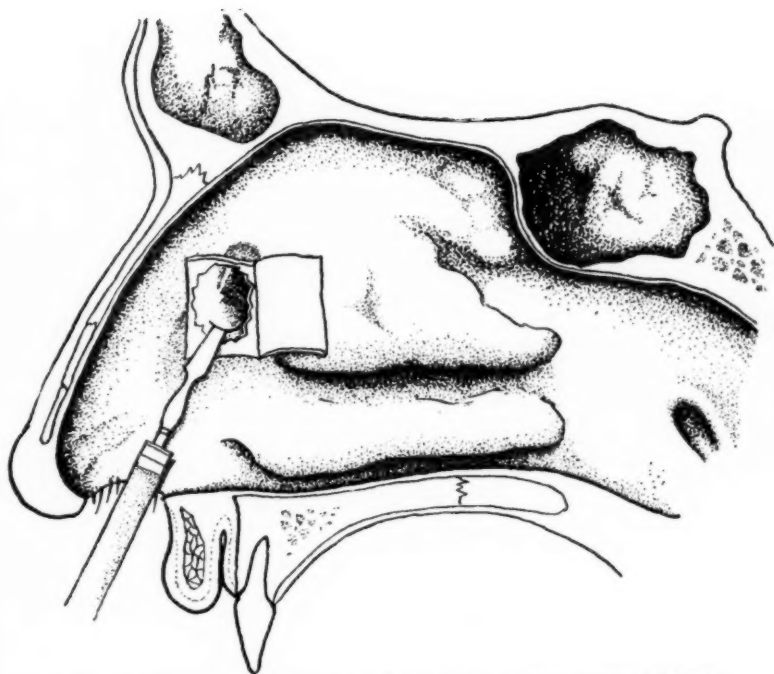
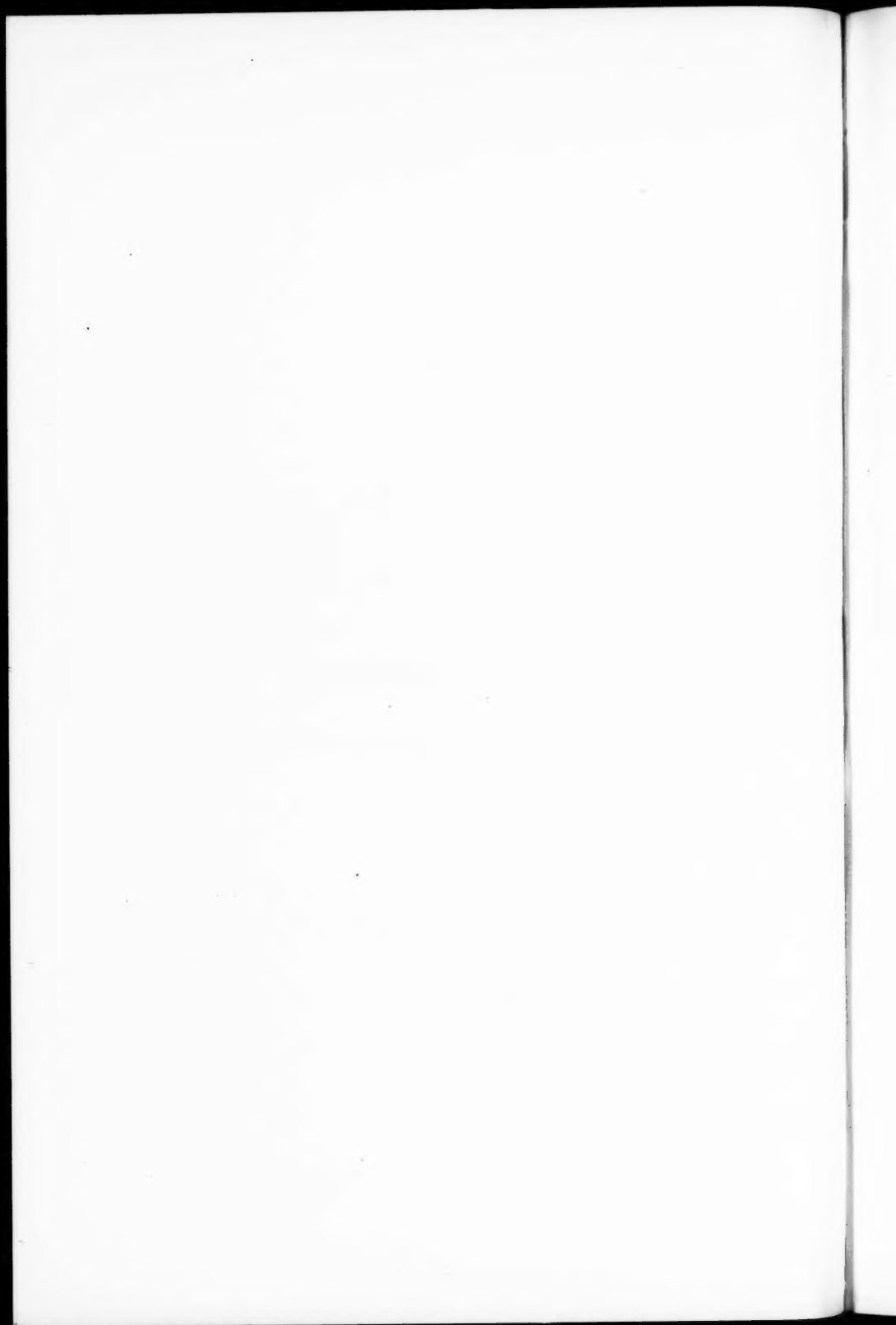


Fig. 7. Flap turned back and incision being made through the bone.



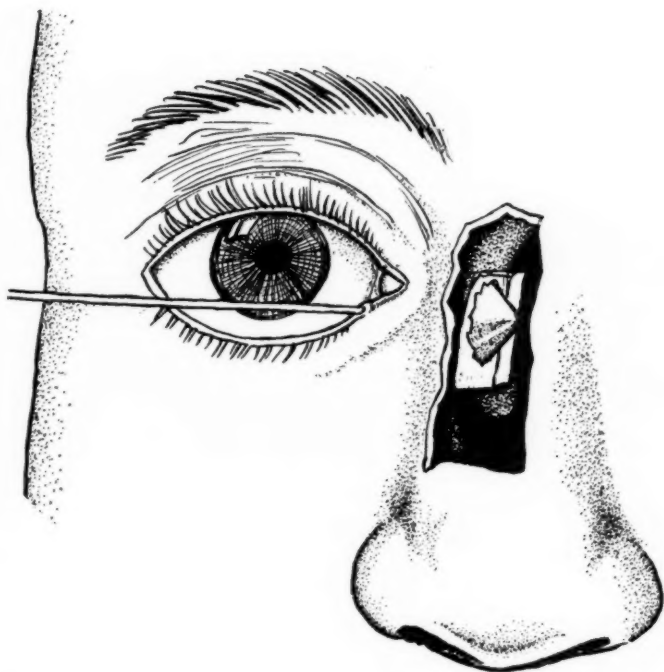
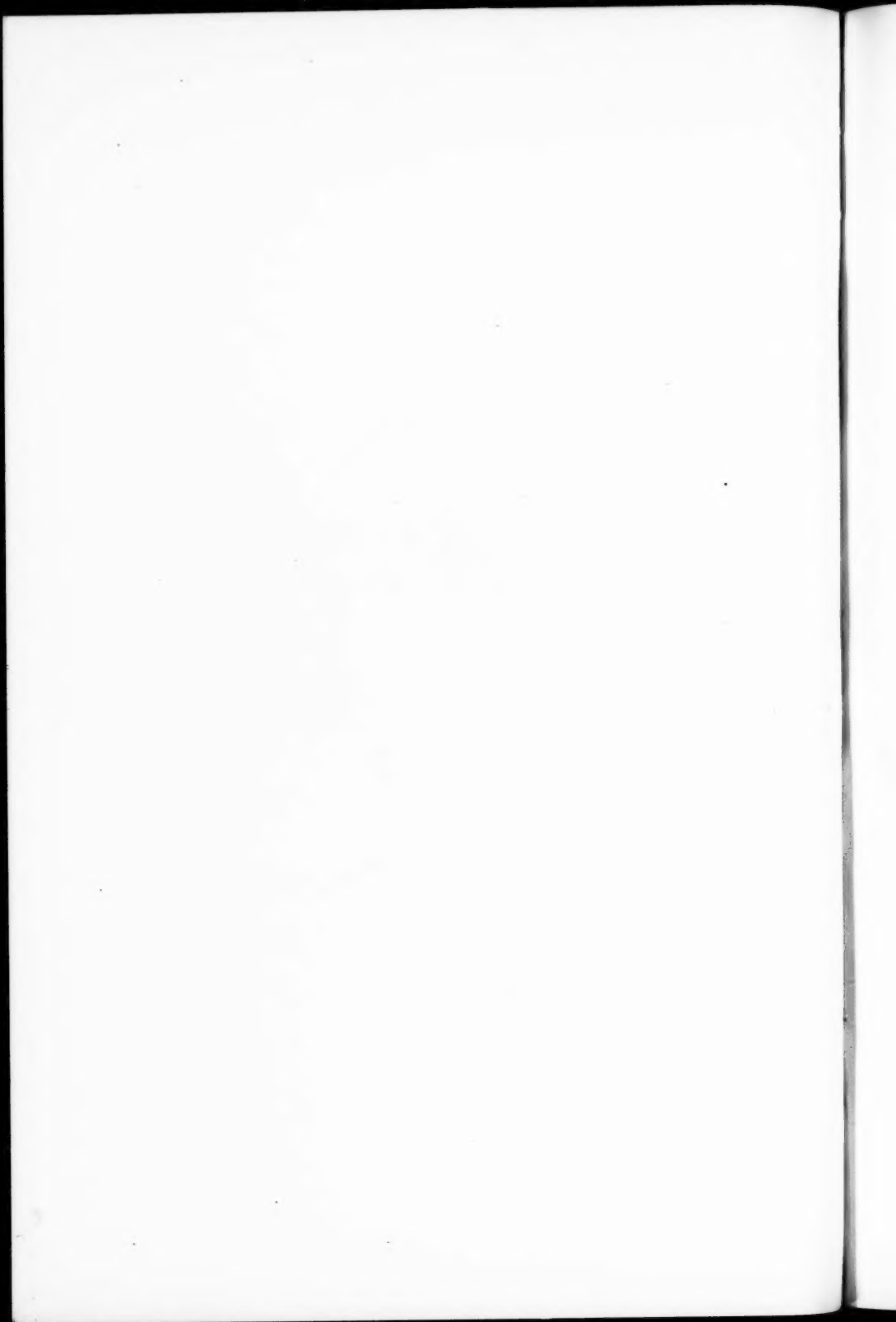


Fig. 8. Showing sac bared and probe passing horizontally into the nose.



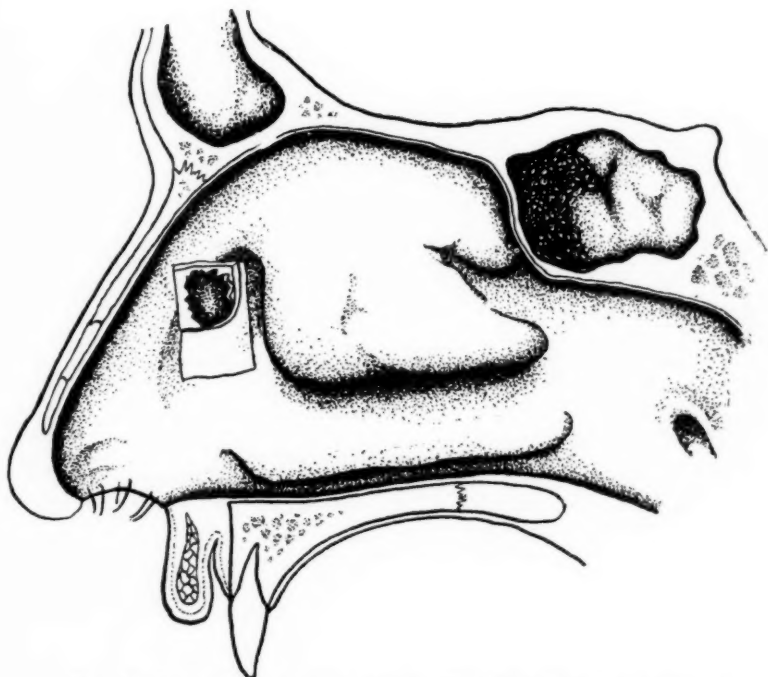
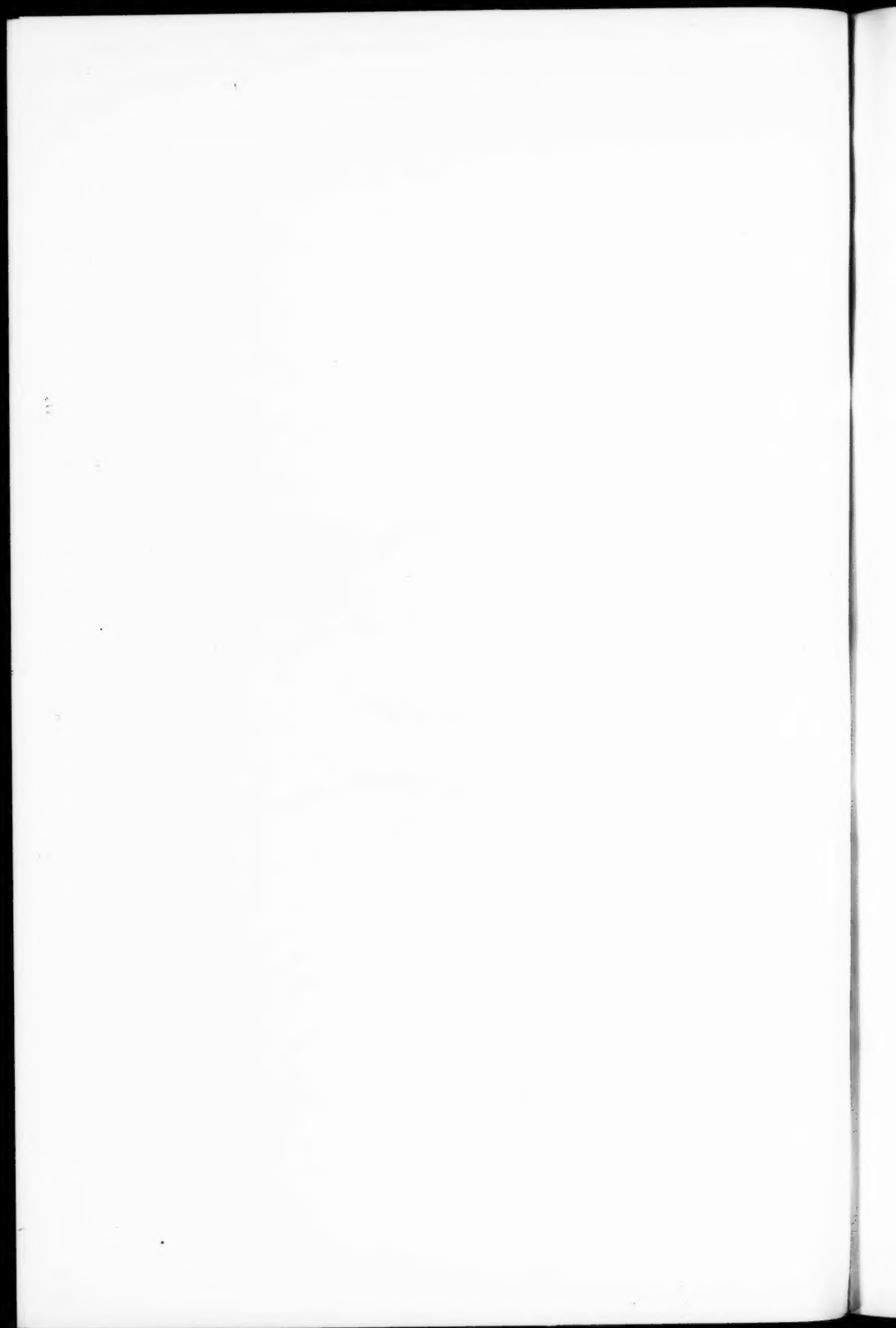


Fig. 9. Lacrimal sac bared above. Flap replaced; the flap cut away above to show this.



XXXV.

SOME OBSERVATIONS ON LOCALIZED PULMONARY SUPPURATION, TREATED BY ENDOBRONCHIAL IRRIGATION.*

BY CHARLES J. IMPERATORI, M. D.,

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Lung abscesses may be divided into three classes, those that are caused by aspiration, by embolism and another type, possibly a tubercular cavitation with a secreting lining of infecting organisms.

The aspiration type of cases have been known to occur in three days; this, however, is exceptional; the abscess usually developing from thirteen to fifteen days after the inhalation of secretions or foreign bodies.

The embolic type usually occurs within three to five days following some operative procedure. It would seem that there should be more cases of lung abscesses, especially of the embolic type, following tonsillectomy, as has been suggested in a discussion by Coakley before the New York Academy of Medicine. The movement of the pharyngeal muscles, the respiratory efforts and the open veins would seem to tend toward embolism; however, from clinical observation these cases are very rare.

Regarding the third type, I am not prepared to enter into a discussion of their etiology at present, but it is hoped at some early future date that I can present before the association further studies.

The following observations have been conducted on patients in Bellevue Hospital on the service of Dr. Coakley, and while

*Read at the Forty-third Annual Congress of the American Laryngological Association, May 30th, 1921, at Atlantic City, N. J.

not a great number, still some conclusions may be drawn from them:

There are seven cases, two being alive and still under treatment. Of the five deaths, one died from a carcinoma of the bronchus and was reported at the February meeting of the Eastern Section of the American Laryngological, Rhinological and Otological Society. One was operated elsewhere, that is, a pneumectomy was done, but the patient succumbed on the table and the other three cases died from an intercurrent pneumonia.

The family history in all these cases, in so far as it concerns our observations, is negative.

The past history averaged about four to six months duration of cough, profuse expectoration and accompanied by more or less pain in the chest.

In two of the cases there was considerable loss of weight.

None of these cases followed tonsil operation, all of them came on insidiously.

The age of the patients ranged from 26 to 52 years and there were six males and one female.

Sinuses and tonsils negative.

All of these cases had varying degrees of pyorrhea alveolaris.

Temperature in most of the cases never ranged over 100 to 101, excepting in one case, that was of the septic type.

They were all ambulant cases, excepting toward the end.

There was no special amount of dyspnea and never any stridor.

Six of these cases showed marked clubbing of the fingers and one of the toes.

Blood examinations, that is differential leukocyte and total leukocyte count, varied so that they were inconclusive.

Bacteriology showed so many different varied bacteria that no definite conclusions can be drawn from this observation.

The diagnosis of all these cases was confirmed by radiographs.

The average size of these lung abscesses was from three to four inches in diameter, and of an irregular outline.

Location in four cases was in the right middle lobe, two in the left lower lobe and one in the right lower lobe.

Repeated sputum analyses were all negative in these cases for tubercle bacilli and yet in the four cases autopsied four showed marked evidences of tubercle.

The amount of sputum was remarkably controlled by bronchial irrigations. General well being and the amount of appetite usually much improved. Less cough. Sleeping much better. Fewer pains in the chest, although, as a rule, following the bronchial irrigations, there would be some chest pains. All of these cases appeared to do well for a time.

The longest time that any one case was under treatment was nine months.

Patients having from three to four cupfuls of sputum a day, that is material raised from the lung and saliva amounting to a pint, could by these bronchial irrigations be reduced to less than a cupful. The number of irrigations given was from one to thirty, average twenty. Starting in with one a week, and as the patients became accustomed to the passing of the bronchoscope which, of course, was done under local anesthesia, they were irrigated every five days.

The apparatus used was usually a 7 mm. Jackson bronchoscope passed through a Mosher laryngoscope and two ordinary bronchial aspirating tubes, one for the injection of the saline and the other for its withdrawal. In the first few cases the Yankauer apparatus, suction and injecting tube, was used but it was too delicate an instrument for hard usage. However, the method is entirely that of Yankauer.

From eight to ten ounces of normal saline solution would be injected into the bronchiole, from which the maximum amount of pus was coming and that had been previously determined at the original bronchoscopy. This would be immediately aspirated through the aspirating tube, some would be ejected through the bronchoscope. When the washings came

through clear, a bismuth-oil mixture was injected; this consisted of 30 grains to the ounce of bismuth-subnitrate in one ounce of olive oil; in latter cases, bismuth-subcarbonate was used. This was properly sterilized before use. As a rule, most of this bismuth mixture would be coughed up before the patient left the table. Bismuth-sulphide was noted in the first washings, at subsequent irrigations, in most of the cases that were irrigated every five days. In some few cases the bismuth remained in the neighborhood of the abscess or in the bronchi. The odor of the sputum was considerably lessened and the extremely fetid characteristic was not so marked. On stopping the irrigations and injections the odor returned and the amount would be markedly increased.

CONCLUSIONS.

Of the five cases that died, four were autopsied and proven, beyond doubt, to be tubercular; one being a carcinoma with a tuberculosis. All of these cases were repeatedly examined, careful sputum analyses made, fluoroscoped, radiographed and decided that they were probably not tubercular and referred from either the medical, surgical or tubercular wards as cases suitable for treatment. The remaining two cases, clinically, have the same characteristics that the other five have.

Simple bronchial irrigations, in the writer's opinion, in the control and treatment of lung abscesses of this type are of little use, except as noted above. It is very possible, with the use of the spiral irrigating tubes of Lynah, better results may be obtained and this method shall be pursued in subsequent cases.

Various medicaments were used in some of the early treatments of these cases, such as iodoform emulsion, iodine in olive oil, tincture iodine, weak Dakin solution—one and ten, and boric acid solution. All with negative results. Warm saline solution and the injection of olive oil, impregnated with the 5 per cent bismuth, seemed to be as efficacious as anything.

Idiopathic lung abscess, and by that is meant that type of abscess other than that directly traceable to aspiration or

trauma of some foreign substance, or the embolic abscess following some surgical procedure, is possibly a tubercular cavitation with a lining area of pyogenic organisms. This cannot be given as a definite conclusion and is merely suggestive from these personal observations, and must be proven by a larger series of cases.

XXXVI.

AN INVISIBLE SCAR METHOD IN COSMETIC
NASAL SURGERY.

BY IRA FRANK, M. D., AND JEROME F. STRAUSS, M. D.,

CHICAGO.

We have for some years been rather dissatisfied with the usual methods of approach in cosmetic plastic surgery of the nose. This dissatisfaction we have felt most keenly in those cases where medium degrees of deformity are presented for correction, such cases carrying with them especially serious hazards for the conscientious surgeon. The failure of an operator to produce desirable results in extreme plastic cases such as old third degree burns, gunshot wounds of the face, and crushing injuries of the nasal bridge, may be countenanced by the patient, and by surgical colleagues—the condition is at least not likely to be worse after operation than before. But in the plastic operations of less degree a far greater responsibility rests with the surgeon; in these cases the patient must be submitted to the minimum amount of risk of cosmetic injury and infection to the end that no disfigurement shall be added to, or substituted for, the original deformity.

The operations of modern plastic surgery of the nose may be classified into two main divisions:

1. Serious malformations, not only of supporting structures but also involving the cutaneous covering of the nose, such as may be produced by crushing injuries, lacerating wounds, cured malignant new growths, granulomas, etc., with marked destruction of the organ and loss of tissue.

These cases have been treated for years with varying satisfaction by the old Italian and the Indian flap methods, and have no place in this discussion.

2. The second group (by far the most numerous in our experience in civil practice) consists of defects of milder degree—moderate deformities of the supporting structures which go to make up the nasal bridge and not involving the skin

of the nose. These are the saddle noses, the humped or hooked noses, and the abnormally broad noses, possessors of which may suffer embarrassment and mental anguish in business life and social intercourse. It is in this type of case that a special responsibility is presented to the rhinologist, in that a correction must be made with the least possible risk to the patient in the matter of finished result, and that the offending feature be made an asset instead of a liability.

The intranasal operations (of continental origin) have been largely used for the correction of these milder deformities. The method consists of an incision made through the mucous membrane of the nose above the superior edge of the triangular cartilage, or at the junction of the frontal processes of the maxillae with the lateral nasal cartilages. Through this incision the periosteum of the nasal bridge is elevated in the midline; humps are reduced to becoming contour with suitable rasps; and for broad noses, by specially constructed saws, the frontal processes of the maxillary bone are sawed through, fractured, and held in proper place by external and internal splints.

The external method, used in America among plastic surgeons, consists of a small horizontal incision over the bridge of the nose at the level of the inner canthi, through which the periosteum of the midline is elevated downwards to the tip. With the field thus prepared, humps are removed, or, in the case of saddle noses, suitably shaped bone or cartilage grafts or plates of inert rigid substance (French ivory) are inserted.

The chief disadvantage of the first or internal method is, of course, the inability of the surgeon to sterilize properly the operative field; and for this reason above all others we have hesitated to subject our patients to such a risk, a risk seemingly out of proportion to the end in view. Further, in our earlier work, when this method was used, we were in many instances unable to gain a satisfactory breadth of operative field on the nasal ridge without running an additional risk by making a similar incision on the other side.

This method may be used in the three principal types of deformities, but is most successful in the hooked nose which is reduced by saw, rasp, or spokeshave. The broad nose requires a bilateral intranasal incision in order to reach both

frontal processes with the saw, which doubles the risk of infection; while in the depressed or saddle nose the suitable graft is passed through the questionably sterilized nostril to the bridge of the nose. This operation we have attempted with subsequent regret.

The external or intercanthal operation is a vast improvement upon the foregoing method and seems now to be gaining in popularity throughout the country, though it is applicable only in humped and saddle noses. It offers a sterile field and a more direct approach to the nasal bridge. In our own experience, however, we have had one regrettable infection of unknown origin, which seriously threatened the final result and terminated in an embarrassing scar on which a secondary plastic operation was indicated. We have also had occasion to regret the resulting scar in a number of other postoperatives by this method.

This unreliability of the result so far as scars are concerned, even though the majority of the cases operated on were satisfactory, offered us a problem of some importance, and our inability to remedy the broad nose through the intercanthal opening gave added significance to our problem.

We have, therefore, modified the external method of operation in a manner which has proved exceedingly satisfactory in our hands. We claim no striking originality in either the method or the technic, and we present it merely as the solution to our problem. We have found that we are able now to operate successfully upon either of the three types of bridge deformity through an incision made in a field readily sterilized and in a location sufficiently hidden to relieve us of all anxiety should malunion, infection, or pigmented scar persist.

TECHNIC.

Before entering the operating room the patient's face and forehead is thoroughly washed with soap and water. With an indelible pencil a line one-quarter inch in length is drawn on the horizontal axis of the left eyebrow, as close to its median extremity as it is possible to approach without extending beyond the hair line. The brow is then partly or wholly removed with scissors, leaving the pencil marked location of the incision plainly visible on the skin. On the operating table the

eyes are covered individually with sterile cotton pads pressed with sterile water, and the remainder of the skin of the face is thoroughly sponged with alcohol-ether. The patient is then put to sleep with ether through a sterile mask, which is discarded for the ethervapor machine as soon as narcosis is reached.

The incision is made one-quarter inch in length, down to the frontal bone (superciliary ridge) through the periosteum. A periosteal elevator with a slightly curved shank (Fig. 1, A) is introduced and the skin and subcutaneous tissues are elevated from the bone and cartilage along the median line of the bridge of the nose down to the tip, the instrument being guided in its subcutaneous course by the operator's hand. (Fig. 2.)

Into the pocket thus formed a slightly curved rasp (Fig. 1, B) may be introduced and humps removed; or in the case of depressed nose, a properly prepared transplant of bone or cartilage may be inserted. For the broad nose, two incisions are required: the usual one in the left eyebrow, and one similarly placed on the right side (Fig. 3). Through these openings the periosteum covering the frontal processes of the superior maxillae is elevated and a small, specially designed saw (Fig. 4) is inserted. The processes are then sawn through at the base of the nasal bridge (Fig. 3) and the walls of the nose are pressed inward to a position cosmetically satisfactory and retained with an external splint of padded heavy sheet copper.

The incisions are closed with interrupted horse hair and sealed with tincture of benzoin over a thin wisp of cotton.

The skin of the nose and the lower forehead lends itself admirably to this operative procedure. It is loosely attached to the subjacent areolar tissue, and consequently is very freely movable. Indeed in some individuals it is possible to use the straight rasps and elevators of the intercanthal operation through the eyebrow incision which can actually be moved inward until it lies in the midline.

The wound heals very rapidly owing partly to adequate blood supply and partly to the fact that there is practically no tension to the skin. The scar is usually invisible through the

regrowing hair of the eyebrow by the time the stitches are removed.

The accompanying illustrations show the few instruments necessary for this type of operation. The rasp and elevator are simple modifications of those used in the intranasal and intercanthal methods. They have been curved to the left to permit their use in the left eyebrow, as the leftsided operation is the one of choice for the righthanded operator. The frontal process saw is merely a segment of a small circular bone saw, attached to a straight shank and handle.

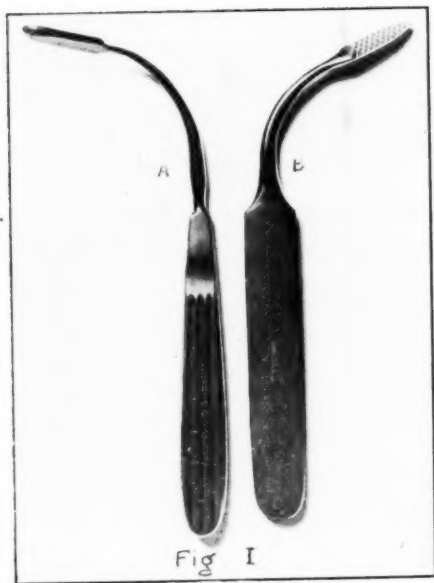
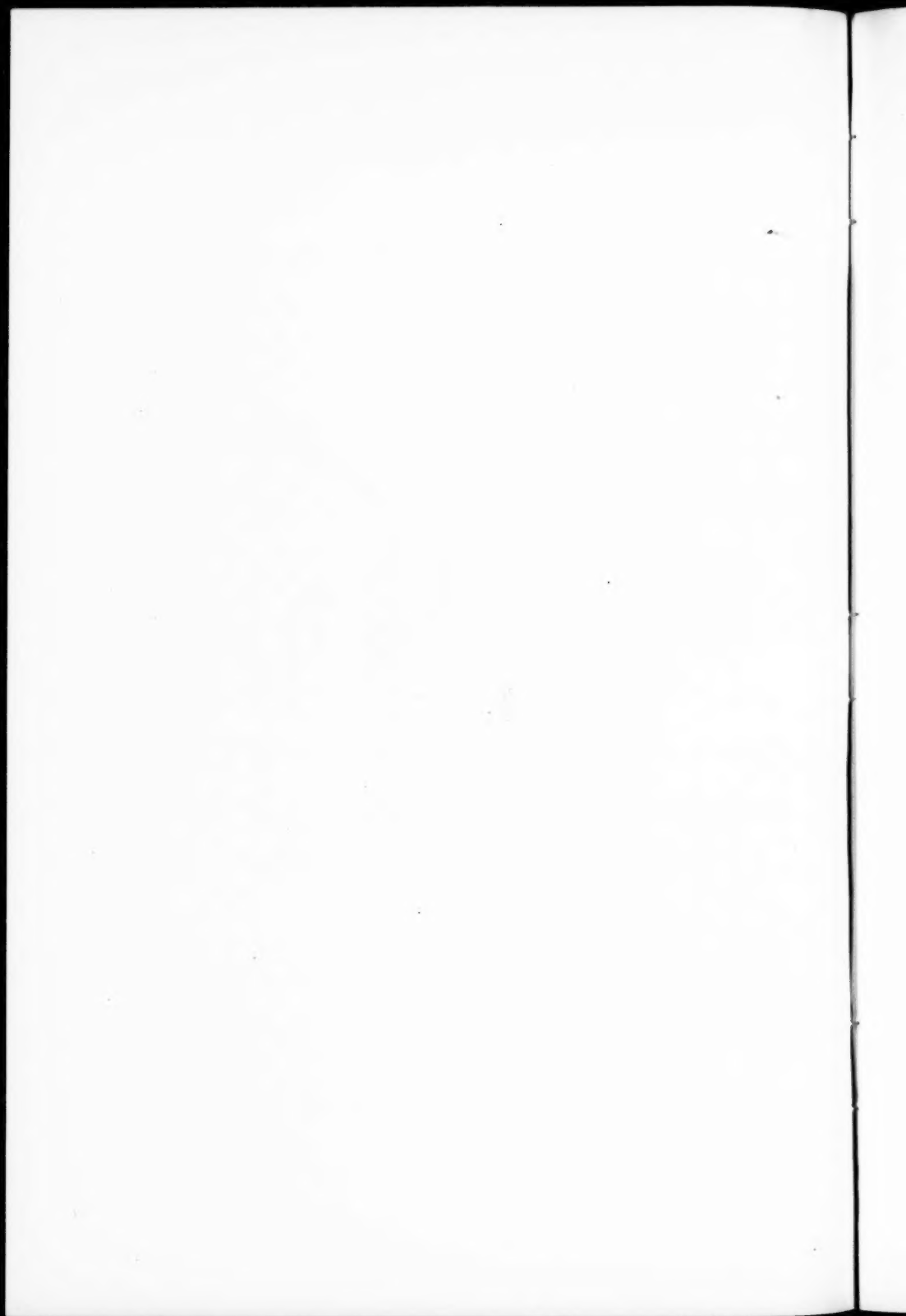


Fig. 1.



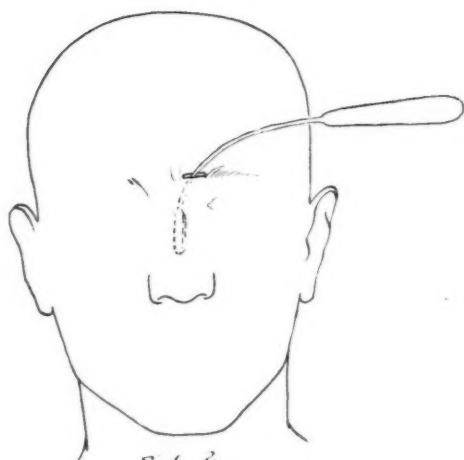
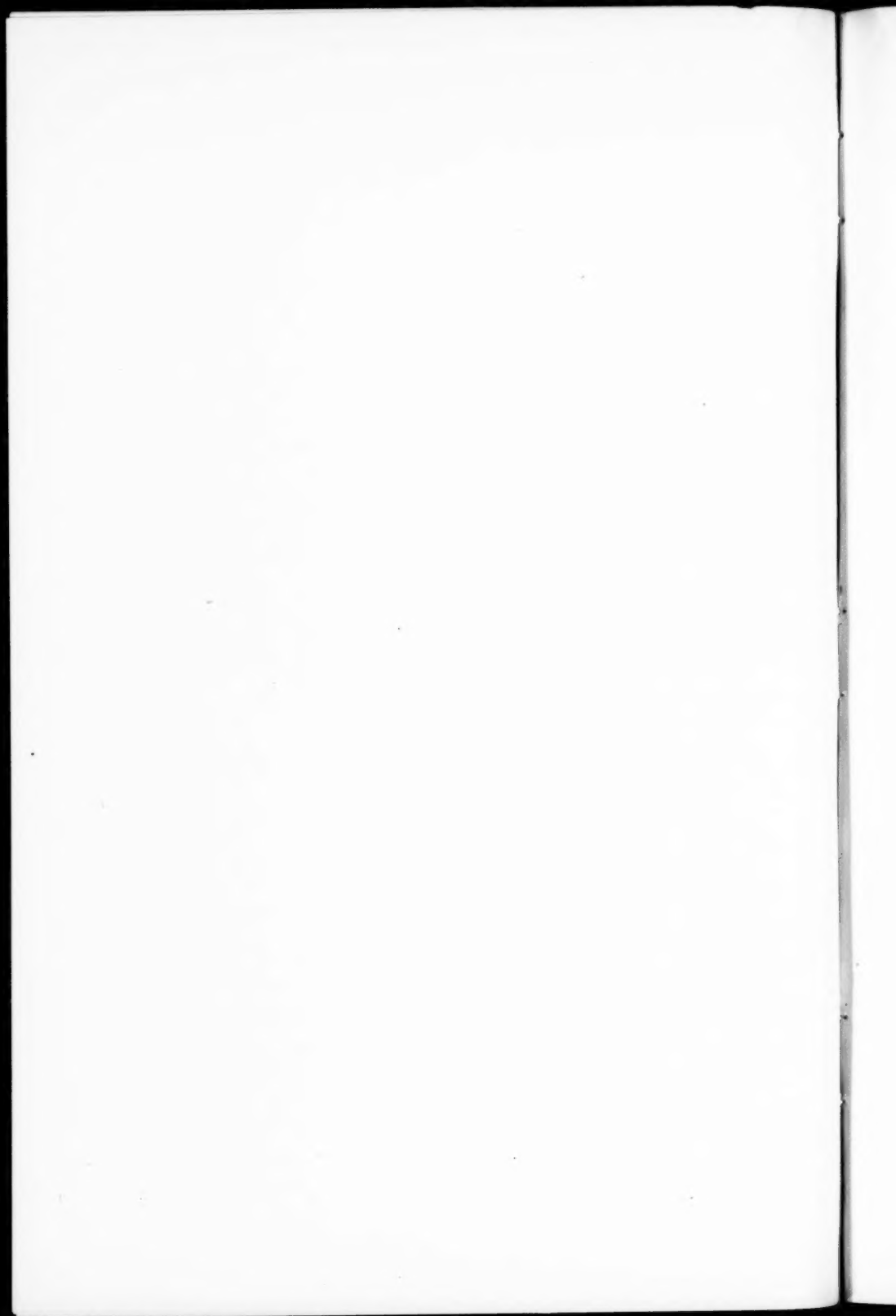


Fig. 2

Fig. 2.



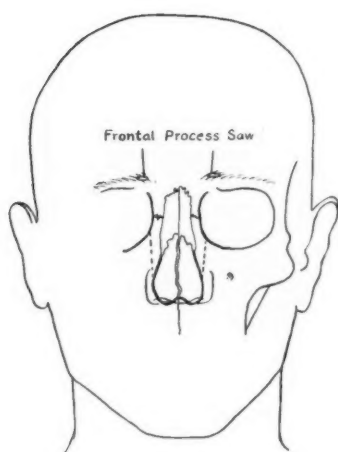
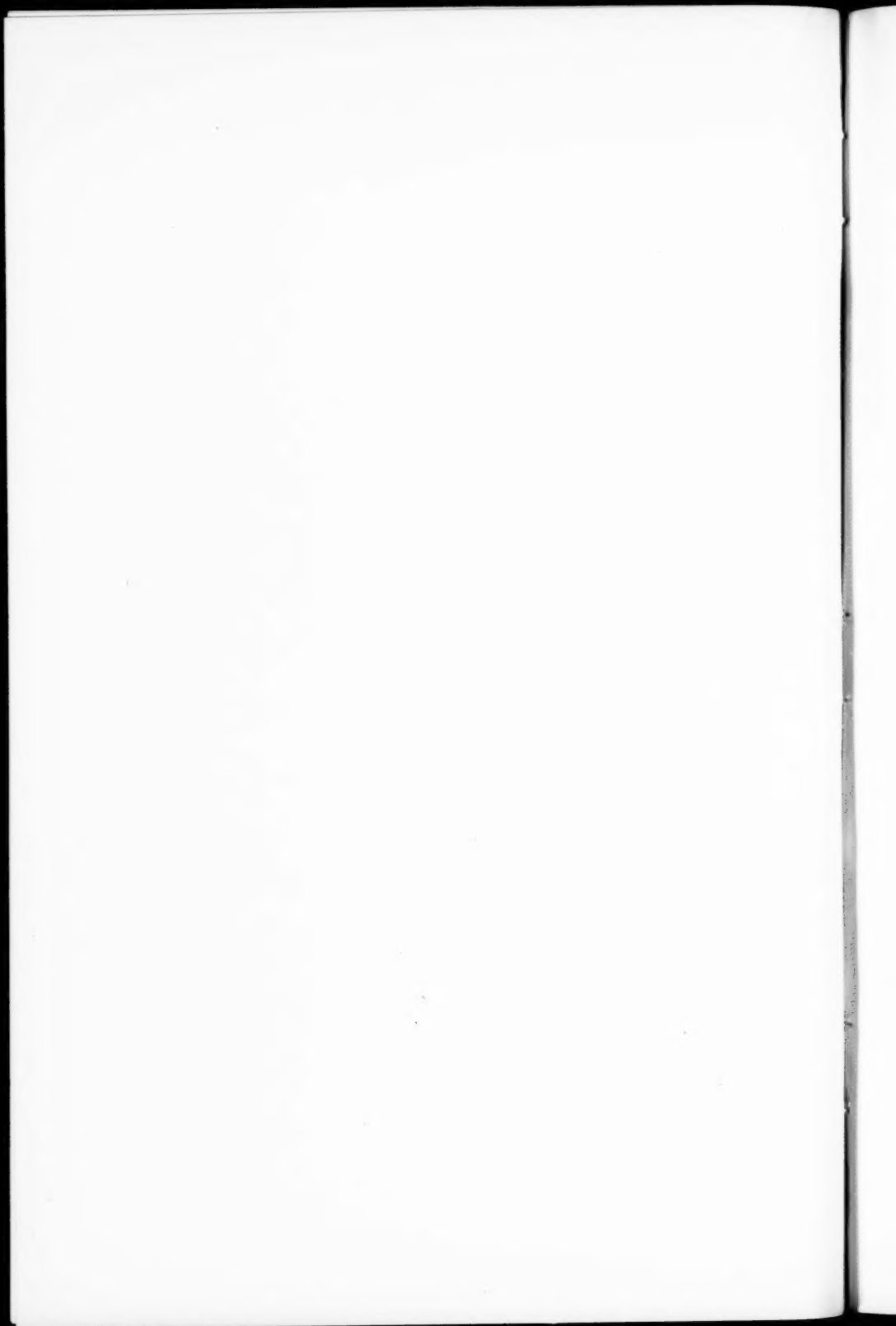


Fig 3

Fig 3.



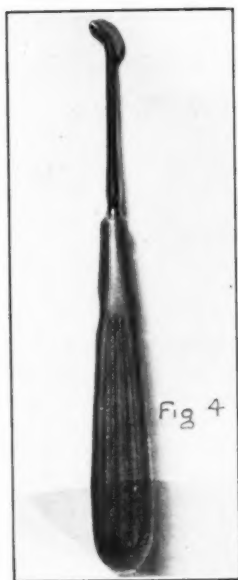
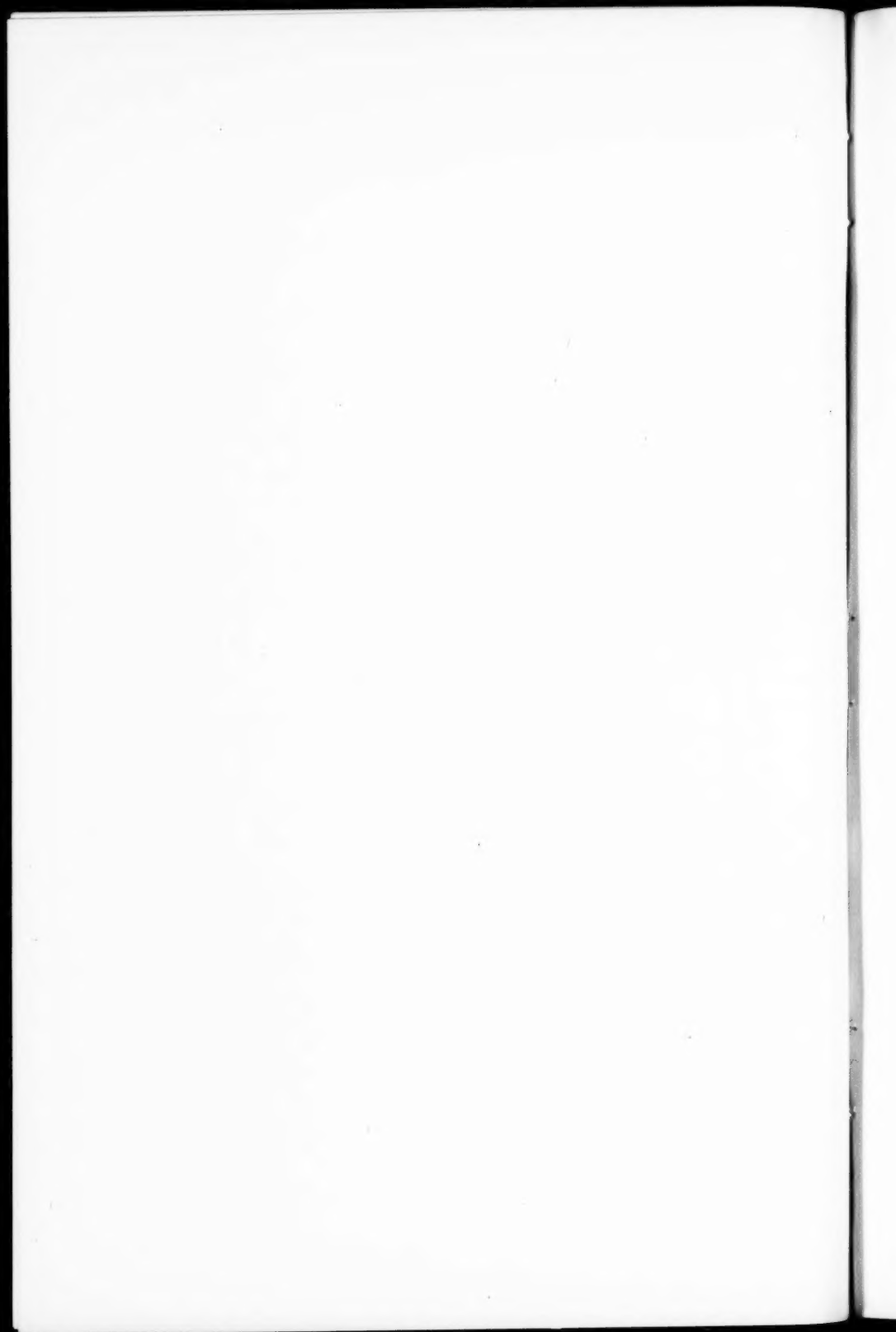


Fig. 4



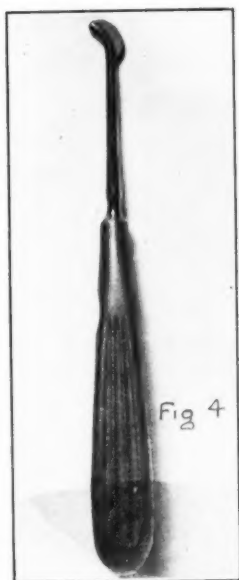
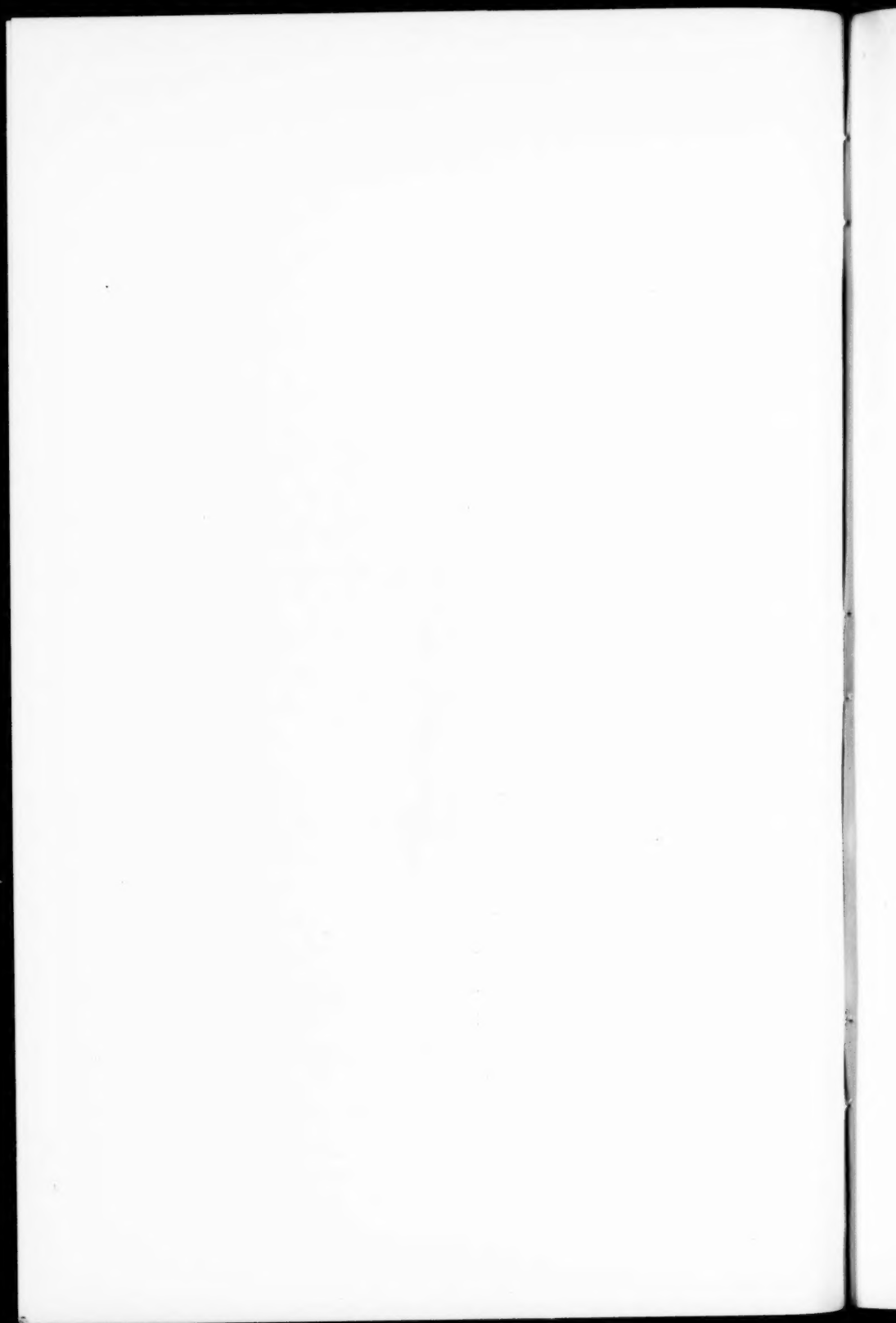


Fig. 4



XXXVII.

THE ACCESSORY SINUSES AS AN ETIOLOGIC
FACTOR IN BRONCHIECTASIS.*

By W. V. MULLIN, M. D.,

COLORADO SPRINGS, COLO.

I intend in this paper to discuss the etiologic relationship of disease of the accessory nasal sinuses to diseases of the bronchi, with the subsequent development of bronchiectasis, and I will begin by stating my own position as I have done previously.

Patients with bronchiectasis will usually be found to have a well-marked sinusitis, and the degree of the bronchial infection is usually in proportion to the amount of sinus involvement present, the well-advanced cases of bronchiectasis having a pansinusitis, as the lantern slides shown later will demonstrate. In going over some of the authoritative literature on bronchiectasis we have not noted such an association mentioned. There have been observations on the nasal cavities as the cause of nontuberculous pulmonary disease—as, for example, those of Rist, Sergeant and Saylor, cited by Gilbert in a former discussion of this subject. But nowhere do we find any emphasis on an etiologic relationship or on the possible pathways of infection linking the upper and lower respiratory fields. Even very recent works, such as the Oxford System of Medicine and Nelson's System of Medicine, make no mention of the sinuses in connection with bronchiectasis. It is of interest to note that McPherson in Osler's System of Medicine mentions brain abscess as a relatively frequent complication of bronchiectasis. The question immediately arises in our mind that since brain abscess is also a frequent complication of sinus disease, do not the bronchiectatic subjects in whom this complication is found develop it not from their bronchi but from an unrecognized sinusitis? While this paper is meant to deal entirely with the sinuses as an etiologic cause, I feel that to

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avoid confusion and make myself understood I should mention that a digest of the views expressed by McPhedrin, Stengel, Powell and Hartley and by MacCallum, permitted us to make the following classification:

1. Bronchiectasis due to mechanical obstruction.
 - a. Foreign bodies in bronchi.
 - b. Tumors, including aneurism.
2. Cases of general "bronchiolectasis" in young children after acute bronchitis.
3. Cases, especially in infants, where there is bronchial dilatation to compensate for atelectasis.
4. Cases associated with fibroid tuberculosis, or other extensive fibrosis, as after empyema or organizing pneumonia, where there is contraction and compensatory bronchial dilatation.

These four groups of known or partially known etiology comprise a minority of the cases of bronchiectasis, and leave a majority to be classed as:

5. Cases attributed to chronic bronchitis or to an acute bronchitis or bronchopneumonia which has left sequelae.

This fifth group of cases includes all not included in the first four. That is, all the obscure cases. In them the history is often vague and the real cause distinctly hypothetical.

Let me here review briefly some experimental work on animals which I have carried on with the help of Dr. Ryder during the last four years. The work falls into two divisions. The first, on the lymph drainage of the accessory nasal sinuses, was reported two years ago. In it we proved, by the use of carbon suspensions and tubercle bacillus emulsions, that the lymph drainage of the antrum is by way of the submaxillary and deep cervical nodes. These latter in the rabbit are long nodes which take the place of the entire deep chain in man, including the retropharyngeal. From these nodes drainage passes onward by the cervical lymph ducts, the great veins, the right side of the heart and the pulmonary artery, to the lungs. The frontal sinuses appear to drain by the same route. We believe this to be the first complete demonstration of this path. Schaeffer, in his recent book on the nose, follows Most, and carries the drainage of the accessory sinuses only as far as the

retropharyngeals, and this dubiously. André, working on the cadaver, concluded that drainage was to the retropharyngeal and cervical nodes, but did not completely demonstrate it. New has noted metastasis of malignant tumors from the antrum to the parotid submaxillary and cervical nodes.

In our first series we also inoculated a few rabbits in the antrum with pneumococci from a human antrum and produced inflammation of the antrum, phlegmon of the neck, an intense tracheitis and bronchitis, and pneumonia.

In the course of the first series we became interested in the question of pulmonary involvement by inhalation. We, therefore, carried out another series, completed last year and in part published, in part about to be. In this second series we found that if india ink or bacterial suspensions were injected into the nasal fossae, or into the antrum in such amount that a good deal escaped into the nasal fossae, they were readily inhaled. In the latter case lesions or pigmentations of the antrum and lung were produced simultaneously.

Thus we have demonstrated the two routes which connect the accessory sinuses with the lungs and bronchi—the lymphatic or circulatory route, which can function even in the case of an antrum which does not discharge at all into the nose; and the inhalation or bronchial route, which is open to any substance reaching the nasal fossae from the accessory sinuses or elsewhere, provided it be converted into droplets or aspirated by sudden inspiration.

Here, then, is the situation: A condition, bronchiectasis, develops inexplicably in a certain number of cases, often with the history of acute bronchitis—a disease nearly everybody has at some time—or of bronchopneumonia, followed by chronic cough. Acute bronchitis and bronchopneumonia as well, though to a less degree, are usually phases of an infection which involves the whole upper respiratory mucous membrane, often including the sinuses.

That sinus infection and acute bronchitis may develop simultaneously is hardly to be questioned. Bronchiectasis does not occur in the majority of the cases of chronic bronchitis, and the tendency is to get well unless fostered and fed by a chronic sinus infection.

I have already demonstrated two routes in which this infection may take place, add to this lowered bodily resistance due to chronic infection and I believe you have the solution. The theory that sinus disease may develop secondary to the bronchial may be put forth, but this is extremely improbable since there is no ready route from the bronchi to the sinuses. The number of cases with cough, moist rales at the bases, particularly in children, who get well after early diagnosis and proper treatment of the sinuses, also disapproves it, as the case of R. L., age 10, will demonstrate when shown.

To those who are inclined to say that the large quantities of secretion coughed up from the bronchi might readily infect the sinuses I might only cite the similar instance in pulmonary tuberculosis without the same coincidence existing.

The coexistence of bronchiectasis and chronic sinus infection in a large number of cases surely must be explained on other grounds than coincidence.

I asked my friends doing chest work to endeavor to find me a case of nonobstructive bronchiectasis without sinus disease. The one case coming without demonstrable sinus disease had the following history which is self explanatory:

John O. Referred by Gilbert, Age 39. Came to Colorado Springs for pulmonary tuberculosis. History: Always well and never had cough until six years ago or at the age of 33. Seven years ago had difficulty with stomach which proved to be an ulcer. He was operated upon for this under ether anesthesia. Began to cough immediately after and has coughed ever since. Now raises quantities of foul smelling greenish material. You will see this case cannot be put in class five.

The slides I am about to show do not represent my whole series, but rather were picked to bring out points that should be emphasized.

1. Many of these cases are mistaken and treated for pulmonary tuberculosis, and the majority of them consult the internist and chest man first. If the patient's history of "no nose trouble" alone is accepted without a most thorough investigation of the sinuses, then the diagnosis will not be made nor the best interests of the patient served.

2. A careful search for sinus disease in the early stages of a persistent bronchitis, especially in children, will clear many cases, while it is very evident that treatment of the infected sinuses in well developed bronchiectasis will not effect a cure.

Every means has been carried out by competent chest men to rule out pulmonary tuberculosis and establish a diagnosis of bronchiectasis.

While this paper deals with the etiologic cause of bronchiectasis, it is because it is the final sequela, and the relationship of the two existing conditions can more easily be demonstrated by slides. But mention might be made of numbers of cases of chronic coughs and bronchitis where a roentgenogram would show nothing, and only a careful auscultation would reveal the true condition.

Careful attention to the histories of this series will show:

1. That the majority of them started with nose trouble and cough when children.

2. That the advanced cases have pansinusitis.

3. That the bacterial flora from the sinuses and the sputa is the same.

4. That those who have only slight sinus involvement, thereby lessening their absorption, do get results by treatment.

5. That a goodly number had no symptom or clinical evidence of sinus disease such as is usually manifested by discharge and headache, especially where the maxillaries were involved.

Because of the lack of appreciation of sinus-bronchus disease as a common clinical entity, it seems desirable to pile up emphasis on this point. For this reason I have recently compiled and reported a series of 14 cases, showing lantern slides of the radiographs of the sinuses and chest. Here I will give in full two cases selected because of their special interest and will summarize the rest.

Case 1.—Miss G. H., is not one of the bronchiectasis, but of pulmonary tuberculosis, and is chosen in order to demonstrate the lymphatic pathway from the upper air passages to the thorax. Radiograph showed calcification of the cervical glands and a continuous chain leading down into the mediastinum. The tonsils were most likely the portal of infection in this case. They were removed under local anesthesia, and a pathologic

examination revealed extensive scars, suggesting healed and fibrosed tuberculosis.

Case 2.—Master R. L., aged 10, I report in detail, because I believe it shows clearly the process of development in these cases and what treatment will do if the diagnosis is made early. Family history negative. Past history: measles at three; tonsils and adenoids removed at four. First seen by the present writer at the age of six because of cervical adenitis. Stumps of tonsils and remnant of adenoid were removed at that time. Good recovery and disappearance of glands. Next seen in June, 1919, three years later, when he was nine years old. Mother brought him because he was having so much catarrhal dropping from nasopharynx. Was seen several times then and not seen again until six months later. This time he was brought in for frontal headaches of such severity that he could not remain in school. Double maxillary sinusitis was suspected and a radiographic plate was made. Report was as follows: "Frontals not well developed or clear; ethmoids not definitely clear; right and left maxillaries decidedly clouded—in fact, it would be impossible to tell from the plate whether maxillary cavities are present or not."

Exploratory puncture, under general anesthesia, of both maxillary sinuses was advised but this was not accomplished, and the boy was not seen until eight months later when he was referred to me in October, 1920, by Dr. H. C. G. with the following report: "A poorly nourished and anemic looking boy. Examination of the lungs shows rales after cough in both bases and some fine rales in the apex of the right lung after expiratory cough. Von Pirquet test—slightly positive. Urine has been examined on five different occasions and albumin, varying from slight trace to a double positive, was found each time. Hyaline and granular casts were found on various occasions. Examination of sputum negative." On October 25, 1920, under ether anesthesia, both maxillary sinuses were opened under the inferior turbinate and the nasoanal floor removed with the bone drill. No pus was found, but on exploring with the probe the mucous membrane appeared to be soft and thick. A piece was removed from the wall of each sinus for pathologic examination. The pathologic report was as follows: "Antrum curettings: Masses of very loose

edematous and congested vascular connective tissue showing marked infiltration with leucocytes both monos and polys. Several hyperplastic lymph follicles present. Surface covered with antral epithelium showing marked papillary overgrowth. No free pus on surface." Another physical examination on November 15th showed the chest free from rales. There was no cough, and the boy has remained well ever since (April 1, 1921).

The following is a summary of the remaining cases of the series. One patient was sixteen years of age, one thirty-four and one forty-eight; the other nine ranged between twenty and twenty-eight years; the youngest patient was the one reported in full, who was ten.

Eight patients gave a history of headaches and nasal discharge from childhood, and the diagnosis of combined sinus and bronchial disease could readily have been made if the possibility had been duly borne in mind. Three had no symptoms of sinus disease and gave no history suggesting it. On the contrary, they were absolutely unconscious of it until the sinuses were radiographed and the pus washed out. One had very slight headache and nasal discharge, but had never associated it with her cough.

Six of the patients had actually gone to sanatoria and had been treated for tuberculosis.

Only one of the series had bronchial asthma, and this was associated with bronchiectasis. He had been thoroughly tested with proteins with negative results, and his asthma was quite certainly due to his nasal disease.

Seven cases were definitely helped by suitable treatment of the sinus condition, plus postural drainage.

In ten cases bacteriologic examinations were made and the same organisms found in the sputum and the discharge from the sinuses. In two cases of hyperplastic type pathologic examinations were made of the tissues removed and these showed chronic inflammatory changes.

XXXVIII.

THE MANAGEMENT OF RECENT FRACTURES OF
THE NOSE.

BY LEE COHEN, M. D.,

BALTIMORE.

It is not my intention to present a lengthy dissertation on a subject which to some may appear too trivial to engage the attention of this august body. I wish simply to place before you a method of treatment which has yielded uniformly excellent results, both as to the external appearance of the nose and prevention of obstructive conditions within, which only too often follow fractures. At the same time I feel also constrained to mention my deep conviction that the rhinologist should apply himself seriously in the matter of impressing upon the general medical profession the importance of early and prompt treatment of nasal fractures, lest the same chaotic state of mismanagement which has heretofore prevailed continue.

Only recently an instance was brought to my attention where the nose of a boy of fifteen was badly broken by a baseball. When seen by the family physician a few hours afterwards he was advised to wait a month before having the "bones set"; a month later, on returning, he was told that it would be best to wait one year before attempting to correct the *now* existing marked external and internal deformity. This may be an extreme instance of the indifference of the general man to the need of seeking expert advice, in such cases, but other instances are constantly being brought to the notice of many of us wherein the patient is dismissed with a simple strip of adhesive over the nose, or told that with the disappearance of swelling all will be well.

However, since most cases are first seen by the general man when the extent of the injury is frequently masked by the enormity of the swelling, it is not surprising that one untrained in this work should fall into such error. Besides, in a survey of the literature appearing in the past twenty-five years, one

is amazed at the small space allotted to the discussion of this subject in most textbooks, and at the utter lack of unanimity in the methods of treatment. All do agree that the constituent parts of the nose should be set in their proper anatomical position—some say immediately, while others advise waiting four or five days for swelling to disappear.

To retain the nose in position the methods mentioned are so varied and often so ambiguous as to leave one beginning the study of the subject largely at sea. Transfixing the nose with pins just beneath the lower ends of the nasal bones, the use of internal metal splints, made fast to the teeth by complicated dental appliances, the placing of Simpson's sponge splints, or the perforated hard rubber splints of Ashe within the nose, and finally packing the nasal vestibule with gauze, may be mentioned as the types of internal support advocated. As to the use of an external support, many contend that none is necessary; that the nose once placed in proper position tends to remain there, supported only from within. This is certainly at variance with my own experience, and likewise with that of others who have given much thought to this matter. Plaster casts, hard rubber splints and other types of stiff plaster molds have been employed. None with which I am familiar, however, are so easily made and applied, or so effective, as the simple copper splints, held in place by adhesive. This type was first used by Dr. John O. Roe in his work on nasal deformities.

The advantages of this splint are manifold. The equal pressure exerted by it over the entire nose holds all fragments in absolute alignment, and prevents their outward displacement, thus diminishing callus formation along the lines of fracture to a minimum. Ridges, offsets and other irregularities in the contour of the nose, so prone to follow fractures, and due to such callus, are thereby prevented. This splint also hastens the disappearance of swelling, and gives to the nose a uniformly good shape not to be obtained by any other which I have tried. Held in place securely with adhesive, trauma and possible refracture during the process of healing are prevented, and lateral deviation of the nose from the middle line of the face so frequently observed after these injuries is obviated.

An experience of some years in corrective rhinoplasty convinces me that the majority of acquired external nasal deformities and a vast number of septal deflections are the end results of fractures faultily treated. The effects of these nasal obstructions in the production of serious local and systemic disturbances are too well known to dwell upon here.

What, then, should be done to impress upon the general medical men the seriousness of treating lightly injuries of this character? My feeling is that the rhinologist should go before the medical societies in his locality and there emphasize the importance of the same prompt expert treatment of fractured bones of the nose as that accorded fractures of other bones; that such cases should be directed to someone able to ascertain the extent of the injury inside the nose as well as outside, and who has been trained to afford the necessary relief. For correction immediately following the injury is a simple matter, as you know, compared with the extensive operative procedure required at a later period.

It has been said that fractures of the nose are infrequent in comparison with other bones of the body. P. Bruns stated some years ago that in over 40,000 patients treated in the clinics and hospitals of Berlin only 1.1 per cent had fracture of the nose. Gurlts estimated that only 1 per cent of all fractures applying for treatment were of the nasal bones. These estimates, it must be apparent to all, are ridiculously low in this country, where football, baseball, basketball and other sports are a regular part of the school life, and where automobile accidents and boxing also furnish a liberal quota.

No time need be spent before this society in general anatomical consideration, but it is well to bear in mind that the nasal bones are quite thin at the lower extremity; hence fracture is most prone to occur at their lower third, and it often requires only a slight blow from the side to cause a break. Also the extent of articulation between the perpendicular plate of the ethmoid and the nasal bones is variable. Zukerkandl found in a large number of skulls that the bony septum extended as far down as the middle of the nasal bones in 40 per cent, to the junction of the lower and middle thirds in 38 per cent, only to the junction of the upper and middle thirds in 10 per cent, and finally in 3 per cent the bony septum did not reach

the nasal bones at all. In isolated instances, therefore, extensive fractures of the nose may occur without involving the bony septum. In such cases, the cartilaginous septum is always broken or displaced, and this makes retention of the nose in the middle line of the face at the time of correction a more difficult task.

Detection of fracture is on the whole easily accomplished. A careful comparison of the relationship of the middle line of the forehead and of the chin with the tip of the nose is often sufficient to convince one of the existence of fracture. Palpation enables us to ascertain whether the break involves one or both nasal bones, and to detect any displacement or irregularity in the contour of the nasal arch. Crepitus may in most instances be elicited. X-ray may show the extent of the fracture, but is by no means essential in making a diagnosis. Inspection of the interior of the nose discloses the extent of septal injury.

Treatment should, in my opinion, be instituted as soon after injury as possible, without awaiting the disappearance of swelling, no matter how great this may be. Even in compound fractures, where suturing of a wound was found necessary, this principal has been followed with the utmost satisfaction. At times it has been deemed wise to give a preventive dose of tetanus serum. The administration of ether has been found best in all cases for the actual operation. After the patient is asleep the extent of the injury and amount of displacement can be better ascertained. A postnasal tampon is introduced to prevent blood finding its way into the nasopharynx.

In young subjects, where organic matter in the bones preponderates, a tendency to lateral deviation of the nose after reduction often exists. This has been especially true where a blow from the side results in a complete fracture of one nasal bone and only a partial fracture of the other—so-called *greenstick fracture*. Satisfactory reduction in such cases cannot be accomplished until all resiliency of the partially fractured bone has been removed by making the fracture a complete one. In other words, in all cases when the nose fails to remain in the proper position after being so placed, it must be so thoroughly mobilized by such further fracture that the flail nose can be molded to suit oneself. For this purpose the Adams forceps

generally serves, but at times the hammer must be called into requisition.

In other cases where the nasal bones can be placed in absolute alignment, there may still exist a tendency to lateral deviation of the entire nose from the middle line of the face, on account of septal displacement. Moreover, there may also exist a depression along the dorsum nasi from the same cause. Replacement of the septal fragments and elevation of the dorsum to the proper plane often requires considerable force. This can best be supplied also by the Adams forceps or one of its modifications. With one blade on each side of the septum, parallel with and just beneath the bridge, the entire nose is, as it were, lifted forcibly forward and upward, moderate pressure being simultaneously exerted on the septum. Generally during this manipulation the slipping of the bone into place can be felt.

Mobilization once accomplished, the replacement of fragments, with a small rubber covered elevator held in the right hand and manipulated from the inside of the nose, while the left hand of the operator remains over the outside, presents little difficulty.

Reduction satisfactorily completed, the anterior portion of both nasal fossae and vestibules are packed with half-inch iodoform gauze tape. No other form of internal support can be applied with such precision, so that greater or lesser pressure may be placed where required; not only is the septum kept in place but the fragments of the nasal bones, no matter how badly comminuted, are prevented from falling inward out of alignment. The fingers of the left hand held over the nose during this process prevents forcing of the fragments outward by too tight a packing.

The external splint should now be applied. Since the publication of the monograph, "The Necessity for Prompt Management of Fractures of the Nose," in *The Military Surgeon* of November, 1918, a number of inquiries have been received as to the splint there mentioned, and its mode of application. One of our leading instrument makers recently wrote asking directions for making it, saying he had orders for same, but as each splint must be made for the individual case as it presents itself, such blanket instructions would be useless. I shall,

therefore, endeavor by means of the motion picture to show the procedure of making and applying the splint.

We first proceed to make a paper pattern. A strip of paper is held across the nose, extending from the frontal notch to tip. A pentil dot on each side of the nose, just above the inner canthi, indicates the limit of the edges of the pattern above, while a dot on each side, in the nasolabial crease, indicates the limit of the edges below. This pattern is then folded down the center, so that the dots on one side of the nose appose the corresponding ones on the other side. Thus folded the pattern is cut in rounded form from one dot to the other. When completed this paper pattern furnishes a true model from which the splint is made. It is now laid on a sheet of 20 gauge copper and its outline marked, after which the metal is cut out with a small pair of tinner's shears, and covered on both sides with adhesive. It is then bent over a piece of iron pipe—in this instance the screen frame answered the purpose. Thus bent a perfect mold is formed to fit over the nose like a saddle. The splint is now lined with surgeon's lint, on the smooth side of which adhesive plaster has been stuck to give it body and prevent wrinkling.

The splint so made is held in place by a $1\frac{1}{4}$ inch strip of adhesive applied in the following manner: One inch from its end a notch, to be placed beneath the right ear, is cut in the upper edge, and the strip made fast to the right cheek, which is pulled forward, as the adhesive is drawn snugly over the top of splint. The left cheek is now held forward and the adhesive made fast thereto, passing beneath the left ear where a similar notch is cut in the upper edge. The cheeks thus pulled forward furnish the elasticity necessary for even and continuous pressure of the splint. Bands of garter elastic and other materials first tried were discarded, for two reasons: firstly, they had a tendency to slip, and secondly, in passing around the nape of neck interference with the return circulation caused headaches. While applying adhesive strip, splint must be firmly held with left hand of operator to prevent displacement of nose. The eyes are completely covered with adhesive when first applied; subsequently the upper half of the strip, extending from one outer canthus to the other, is cut away to make space for vision. The strip is now too low

down on the splint, and unless placed on a higher level so that pressure is brought to bear about the middle of the bony arch, depression of the nasal tip is likely to result. Likewise the tension of the adhesive on each side of strip must be equalized, lest lateral deviation of the nose follow. Palpation of strip, with one index finger on each side, will detect the slightest inequality.

Balancing tension and placing adhesive strip on a higher plane is accomplished by means of a small elevator made for this purpose, heated quite hot over a spirit lamp to prevent adhesive sticking to it. This hot elevator is passed from below upward, between splint and adhesive, and the strip raised clear of the splint. Thus held the plaster may be shifted to any desired position. A pencil dot in center of upper edge of splint, and one directly below it on upper edge of strip, aid much in judging the extent of change made in shifting the adhesive.

Last, an additional strip of adhesive half-inch wide is placed vertically from the lower end of splint over the middle of forehead to the hair line. This strip, reinforced with two cross strips on the forehead and two over the splint itself, prevents it from slipping downward.

Perforations in the splint, made by a small dental punch, add greatly to the comfort of the patient and lessens maceration of the skin during hot weather.

The external splint is worn over a period of four weeks, but changed every fourth day, at which time the skin beneath is cleansed with alcohol. Packing within, while changed every third day, is discontinued after the tenth day.

Photographs here shown are of a 16-year-old boy, struck on the nose with a baseball. He was discharged only a few days ago, having worn the splint one month.

1820 Eutaw Place.



Fig. 1—Type of splint employed.

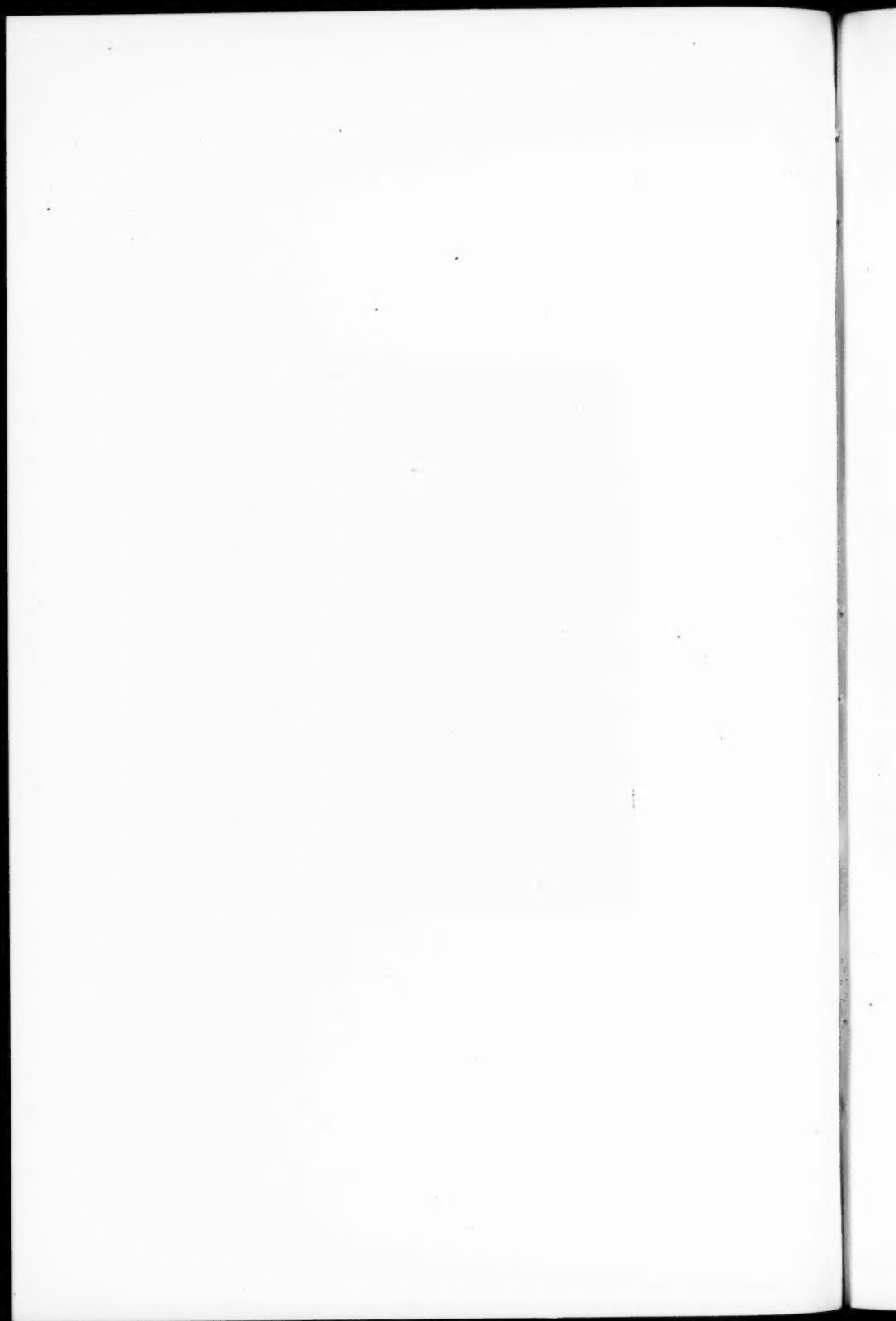




Fig. 2—Fractured nose, six hours after injury.

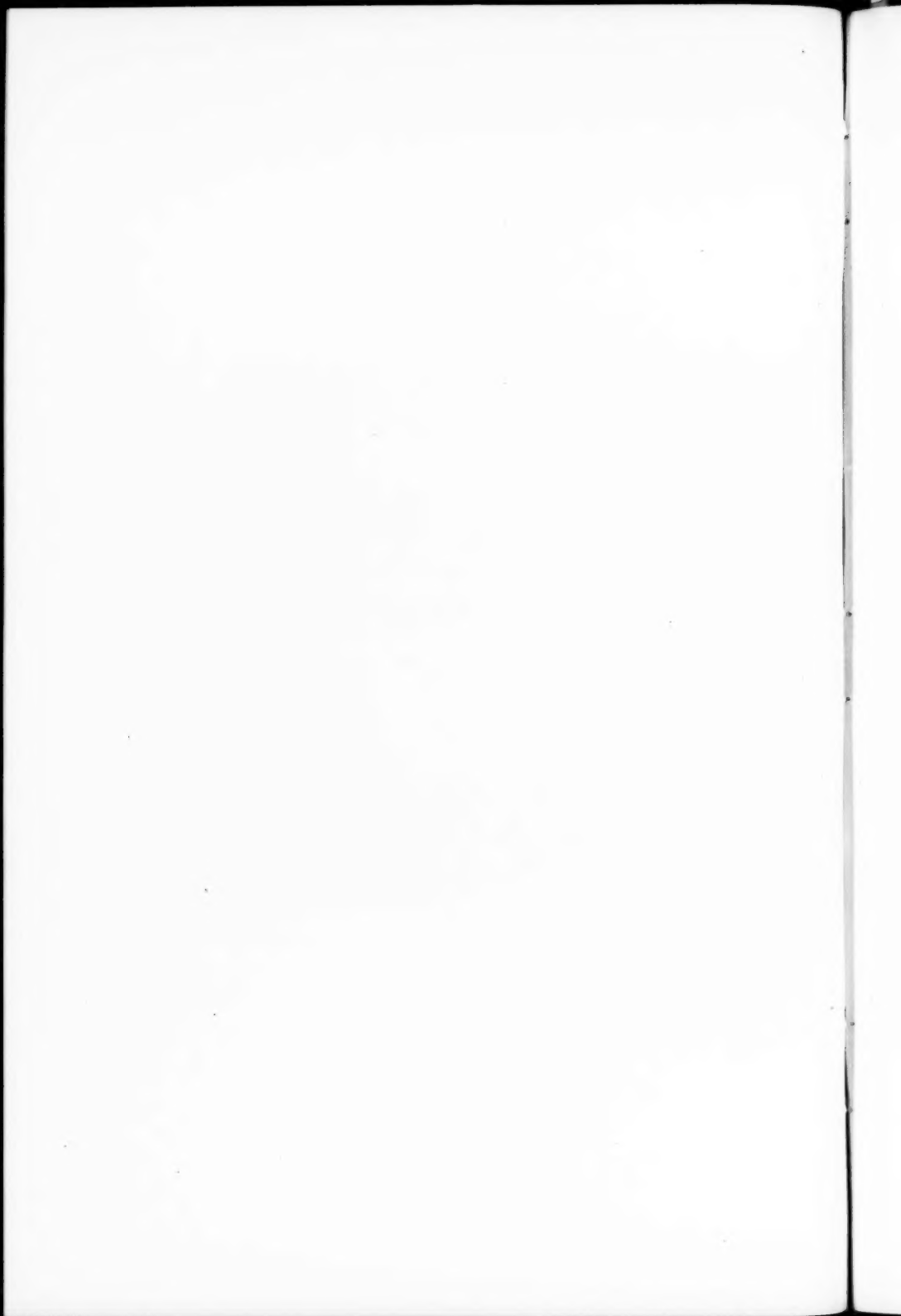
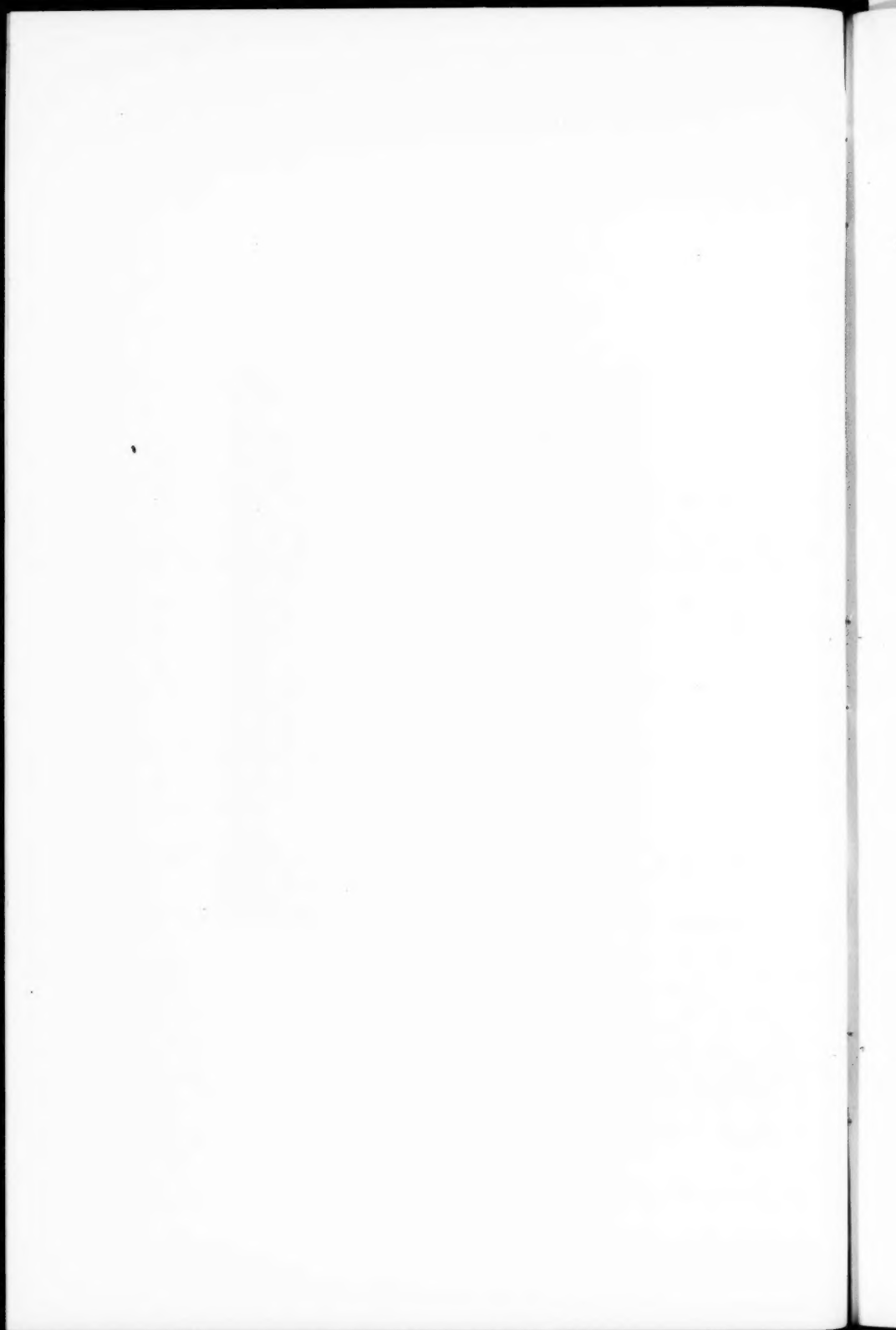




Fig. 3—Four weeks later.



XXXIX.

RESONATORS AS POSSIBLE AID IN TUNING FORK
TESTS—A PRELIMINARY REPORT.

BY ROBERT SONNENSCHN, M. D.,

CHICAGO, ILL.

On November 19, 1912, I read before this society a paper entitled "Resonators, with Special Reference to the Schaefer Apparatus." It will, perhaps, best serve our purpose at this time to quote largely from that article a number of selections:

"To properly appreciate and intelligently apply a subject like otology, and particularly the functional testing of the ear, requires, it would seem, some knowledge of acoustics which embraces among other topics, the subject about to be discussed.

"In the consideration and application of resonance and resonators, we have a most interesting and important field bearing on the appreciation of many phenomena connected with hearing and with the voice, besides offering those who are concerned with the study of acoustics per se a splendid opportunity of solving many different questions. Resonators have been used in various ways, for instance: by Helmholtz and others, for the analysis of tones, particularly of the different vowels; by Wien for the determination of tone intensities; by Abraham and Schaefer for the purpose of solving the difficult problem of 'interference tones'; by Schaefer and later by Waetzmann to furnish proof of the existence of objective physical combination-tones in the sounds produced by vibration of membranes or diaphragms. It seems that a useful application of resonators would consist in testing therewith the various forks which we buy in order to be certain of their pitch should any doubt exist and no other accurate forks be at hand with which to compare. A few years ago Edelmann constructed and introduced a continuous series of resonators evidently intended to supplement the Bezold tuning forks. This will, perhaps, lead to the former becoming a part of the otologist's armamentarium.

"Resonators, be it said, are instruments capable of and used for selecting out special sounds for reinforcement. Resonance, or sympathetic vibration, which is the reinforcement or intensification of sound due to the union of direct and reflected waves, depends upon the principle that a number of slight impulses properly applied will finally create a considerable momentum, as seen in the well-known fact of giving impulse to a swing or a pendulum at the proper phase of the oscillation. When, therefore, a vibrating body is brought near the corresponding resonator the latter is caused to vibrate in its fundamental tone. To induce a rigid body like a tuning fork to respond to or resonate with another fork, or other sounding body, requires that both objects have exactly the same number of vibrations per second, or that the vibration number of one is a simple multiple of the other. When, however, a more elastic substance such as a column of water or air is used as a resonator, the two sounds need not be absolutely in unison, but should be nearly so. In most resonators a column of air is employed, as is also the case in the Schaefer apparatus.

"To produce a resonator for any one tone is a comparatively simple procedure. A lamp chimney, a tube of cardboard or a bottle may do. By placing in water a cylindrical glass or metal tube open at both ends, and having a length of approximately a meter, and a diameter of a few centimeters, it can be made to resonate for tones ranging from about 100 to 3,000 vibrations per second, depending upon the depth of the immersion. The disadvantage, however, of these water resonators lies in the fact that the ear of the person to be examined cannot easily be connected with the node of the air wave which is formed at the surface of the water column. For this purpose the spherical resonators of Helmholtz are very serviceable in that they have opposite the sound opening a small funnel-shaped open tip or prolongation which can easily be inserted into the ear.

"A resonator open at both ends reinforces better a higher tone than one open only at one end. In other words, resonators of this type are of higher pitch than those in which one end is closed. On the other hand, a resonator is of deeper pitch: (1) the larger the air containing area, and (2) the narrower the sound opening (Schalloch) happens to be.

"Schaefer advises using resonators in the analysis of sound without insertion into the ear because the instruments are caused to vibrate by very slight disturbances, such as faint noises or sounds. The fundamental tone of the respective resonator is thus produced, giving confusing results. But this very sensitiveness of resonators can be utilized in otology, for the introduction of the apparatus into the ear will serve as a last resort in the hearing of an otherwise inappreciable sound. Therefore, perhaps, the diagnosis of total deafness should not be made until a fairly loud sound intensified by the corresponding resonator fails of perception.

"Tones of medium pitch are the ones most intensely reinforced, the very low and the very high ones much less so. Schaefer, Koenig and Helmholtz maintain that there is no practical value in producing resonators with less than a hundred double vibrations, that is, about A (108 v. d.).

"Each Koenig or Helmholtz resonator gives a maximum reinforcement for one certain tone, but less for sounds just above or below this one. There are certain tones, therefore, lying between succeeding resonators which are not reinforced to their maximum.

"Schaefer claims that the ideal instrument is a 'continuous or universal resonator apparatus, adjustable for any desired tone between at least c (128 v. d.) and c3 (1024 v. d.), one producing maximum reinforcement of every tone, easily manipulated, compact and comparatively cheap.' These qualities are held to be embodied in his apparatus.

"These resonators are four in number, of different lengths but the same diameter, cylindrical in shape, and made of brass. One end is open, the other closed by a plate having a central aperture. Over the latter is a conical extension intended to be placed in the meatus auditorius or to be connected with a tubing for introduction into the ear. For occluding the small opening when the resonators are not to be inserted in the ear, rubber plugs are provided.

"Each resonator tube fits accurately into another cylinder but can be moved in and out. The inner tube is graduated in millimeters, so that the length of the resonators, depending on the amount that the inner tube is withdrawn, can at a glance be read. At the same time the tones for which the resonator

acts at different lengths are indicated by letters giving the notes of the scale. As is customary in Germany, H is used to designate the b of our scales. The resonators are graduated to correspond to the tones of the temperate scale, based on the tone of a^1 (435 v. d.) at a temperature of 18° C. (about 64.4° F.). Experiments have shown, however, that at ordinary room-temperature varying somewhat from 18° C., no correction in reading is necessary. The range of these resonators is from about A (108 v. d.) to a little above c^3 (1024 v. d.).

"The graduation is also based on the assumption that the smaller opening is closed when the resonators are used. When applied in the ear the drum acts as obturator, but when used outside the ear the smaller aperture should be occluded with a rubber plug or the end of a finger. Otherwise inaccurate result will be had, for a resonator open at both ends is of higher pitch than one in which only a single end is open, as was previously pointed out. Judging by a few experiments, this difference in pitch amounts in most cases to about one-half of a tone. It has been shown that the freely movable membrana tympani acts just as well in closing one end of the resonator as does the rubber plug. It will be interesting to see what effect the presence of a perforation in the drum membrane has as regards the pitch of the resonator used.

"There has been considerable dispute regarding the advantage of spherical over cylindrical resonators, Helmholtz supported by Watson and others claiming that the former give a purer tone and a more powerful resonance. Schaefer, on the other hand, disputes this statement, and claims that even granting it for the lowest and highest tones only, the difference is so slight as not to count from a practical standpoint.

"Resonators can therefore be used for various purposes: (1) In physical research in the analysis of tones, etc.; (2) in testing tuning forks to see if the actual tone is the one claimed to be present; (3) for determining the pitch of unmarked forks, or that of any other sounding body whose tone comes within the range of the resonators used; (4) and last, but not least, for testing the absolute duration of hearing. With the corresponding resonator inserted in the ear, a tuning fork, no longer heard alone, will still be appreciated; but when its

sound ceases to be heard despite reinforcement the limit of hearing has been reached. To determine actual deafness forks not at all heard alone can thus be used with resonators to establish the diagnosis."

The present paper covers examination of fifty unselected consecutive cases, and is only preliminary in character. It is our intention to use the resonator for a considerable time in order to see what findings may be had in a large series and then to report more definite conclusions, if possible.

At this time I desire to express my thanks and deep appreciation to my Associate, Dr. S. J. Pearlman, for the great aid he has given in the examination of the patients.

The tests were made in this manner. The a^1 fork (435 v. d.) was excited in a uniform manner by holding it at right angles to the body and allowing a small rubber pleximeter to fall of its own height and weight from a perpendicular position directly upon one of the prongs. When the fork was no longer heard by air conduction the time was noted, the tip at the end of the tubing connected with the resonator attuned to the tone of a^1 was then inserted into the ear, the fork held near the resonator and the fact noted, either that the sound was not again appreciated by the patient, or if heard, for how long a period.

In order to facilitate the handling of the resonator we had a frame or cradle constructed in which it lies so that the tubing could be inserted into the ear without disturbing the resonator.

We have used the a^1 fork (435 v. d.) since its pitch lies in the speech area designated by Bezold, and if not heard by air, usually means that all hearing for speech is lost.

The use of the resonator is better than increasing excitation of the fork by again striking it when the patient no longer hears it, as we cannot then get uniform increase in intensity of vibration such as a resonator set at the same point always produces. It is true that holding the resonator to the normal ear often gives a sound like that of a sea shell, due to the reinforcement by the resonator of any sound in the surrounding air which has the same pitch as that to which the resonator is attuned, or which is an overtone of that sound. This is often confusing to the person under examination, as he cannot then very well distinguish between that adventitious sound

and the tone of the tuning fork of the same pitch, especially when the intensity of vibration has already greatly diminished after a certain length of time. This may to a large extent account for the discrepancies in findings with the resonator, especially in those cases with good hearing where the tuning fork is heard for a long time via air, and then when no longer perceived is held near the resonator now connected with the ear. That the noise in the downtown district, where most of us have offices, may have a bearing on this fact is, perhaps, shown by the results obtained in those persons (Nos. 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13) who were tested in a quiet room in the residential section, and in everyone of whom there was a distinct and often very marked increase of hearing of forks by the resonator when no longer heard via air.

At the same time, this very fact of the resonator producing a reinforcement of the sound in the surrounding atmosphere corresponding to its fundamental tone may prove of assistance in determining the pitch of a tinnitus aurium. By changing the length of the resonator the patient may be able to tell when the pitch approaches or coincides with his own head noises. The pitch of the latter, as we know, varies often, depending on whether a nerve degeneration or a middle ear lesion is present, being high in the former and usually low in the latter.

The degree of the person's intelligence is also a factor as indeed it is in all hearing tests, for they are, in the main, subjective ones and we are dependent upon the patient's own statements. It is therefore necessary to show him exactly what is desired so that he may closely observe and give reliable statements.

Where the resonator no longer caused the fork to be heard after the patient stated it had stopped sounding by air (for instance, 40 seconds), it was possible that the fork had actually ceased vibrating and therefore its tone could, of course, no longer be accentuated by the resonator. To check this the fork was again excited in the usual manner and held near the resonator connected with the ear, and the time noted during which the fork was heard to see whether the actual duration of hearing was now the same as before. It was rather surprising to note how long a good fork like the Edelman a¹ vibrates beyond the time usually detected by the unaided ear.

The otologist may use any resonator he desires which is attuned to the fork to be employed, but we have used the Schaefer apparatus because it is accurate, compact and easily adjusted.

The greatest value of the resonators probably lies in the ability to test absolute duration of hearing for those forks especially whose pitch lies in the speech area. It is unfortunate that many cases of far advanced impairment of hearing do not appear in our series, but as previously pointed out, those reported were unselected. At a future time we hope to have results in a large number of defective ears. It will also be interesting to note in a larger series what effect perforations of the drum membrane may have in altering the pitch of the resonators.

So far as I am aware, resonators, while used very extensively in purely physical research, have not been employed in clinical work. While we cannot in this paper propound or prove any startling fundamental principles, we do feel that it is much worth while for all of us to utilize any means at our command to study phenomena of hearing in order that some benefits in the way of aids to diagnosis or treatment may be evolved. An appliance which at first sight does not offer much prospect of improving our technic may on closer investigation add at least a small contribution to the refinement of our methods of functional testing of the ears. I trust this thought will justify my inflicting this paper upon you this evening.

Following are the tables showing the findings in the fifty cases examined:

Name	Sex	Diagnosis	Welder	Schwabach	Ring	Drum Membrane	Supra- tation	a fork via air	Resonator in seconds	Whispered voice
No.	Age				r. l.	r. l.	r. l.	sec	r. l.	r. l.
A. V.	No. 1	Auditory nerve degeneration.	Not Lat.	Much shortened (25 secs)	+	Both dull and retracted.	0	0 15	18	Not heard.
N. 2	No. 2	Recurrent otitis media. (Now dry.)	"	Slightly lengthened	+	Dull	0	0 50	37	8 Meters
M. 22	No. 3				+					
H. T.	No. 4	Normal ears.	"	Normal	+	Neg.	0	0 50	40	65 60
M. 23	No. 5		"	"	+	"	0	0 47	45	75 65
M. 24	No. 6		"	"	+	"	0	0 45	44	73 70
M. 25	No. 7		"	"	+	"	0	0 48	58	75 100
E. Z.	No. 8		"	"	+	"	0	0 50	50	83 90
M. 26	No. 9		"	"	+	"	0	0 55	45	92 82
M. 27	No. 10		"	"	+	"	0	0 50	35	76 70
M. 28	No. 11		"	"	+	"	0	0 55	45	62 68
M. 29	No. 12		"	"	+	"	0	0 55	54	83 105
M. 30	No. 13		"	"	+	"	0	0 54	60	75 76
M. 31	No. 14		"	"	+	"	0	0 43	44	55 80
M. 32	No. 15		"	"	+	"	0	0 43	44	55 80
M. 33	No. 16		"	"	+	"	0	0 43	44	55 80
M. 34	No. 17		"	"	+	"	0	0 43	44	55 80
M. 35	No. 18		"	"	+	"	0	0 43	44	55 80
M. 36	No. 19		"	"	+	"	0	0 43	44	55 80
M. 37	No. 20		"	"	+	"	0	0 43	44	55 80
M. 38	No. 21		"	"	+	"	0	0 43	44	55 80
M. 39	No. 22		"	"	+	"	0	0 43	44	55 80
M. 40	No. 23		"	"	+	"	0	0 43	44	55 80
M. 41	No. 24		"	"	+	"	0	0 43	44	55 80
M. 42	No. 25		"	"	+	"	0	0 43	44	55 80
M. 43	No. 26		"	"	+	"	0	0 43	44	55 80
M. 44	No. 27		"	"	+	"	0	0 43	44	55 80
M. 45	No. 28		"	"	+	"	0	0 43	44	55 80
M. 46	No. 29		"	"	+	"	0	0 43	44	55 80
M. 47	No. 30		"	"	+	"	0	0 43	44	55 80
M. 48	No. 31		"	"	+	"	0	0 43	44	55 80
M. 49	No. 32		"	"	+	"	0	0 43	44	55 80
M. 50	No. 33		"	"	+	"	0	0 43	44	55 80
M. 51	No. 34		"	"	+	"	0	0 43	44	55 80
M. 52	No. 35		"	"	+	"	0	0 43	44	55 80
M. 53	No. 36		"	"	+	"	0	0 43	44	55 80
M. 54	No. 37		"	"	+	"	0	0 43	44	55 80
M. 55	No. 38		"	"	+	"	0	0 43	44	55 80
M. 56	No. 39		"	"	+	"	0	0 43	44	55 80
M. 57	No. 40		"	"	+	"	0	0 43	44	55 80
M. 58	No. 41		"	"	+	"	0	0 43	44	55 80
M. 59	No. 42		"	"	+	"	0	0 43	44	55 80
M. 60	No. 43		"	"	+	"	0	0 43	44	55 80
M. 61	No. 44		"	"	+	"	0	0 43	44	55 80
M. 62	No. 45		"	"	+	"	0	0 43	44	55 80
M. 63	No. 46		"	"	+	"	0	0 43	44	55 80
M. 64	No. 47		"	"	+	"	0	0 43	44	55 80
M. 65	No. 48		"	"	+	"	0	0 43	44	55 80
M. 66	No. 49		"	"	+	"	0	0 43	44	

No. 16 F. 28 Lat. left.	Longitudened slightly lengthened	+	—	Neg. Moderate perforation	0	+	30	25	40	30	7M.	4M.
No. 17 C. 8. Lat. right	Otitis media chronica dextra.	—	+	Large perforation from small	+	0	30	60	30	60	1M.	6M.
No. 18 M. 7. Lat. "	Otitis media acuta dextra.	"	+	Small perf.	Neg.	+	0	20	50	25	50	0.5M.
No. 19 M. 7. Lat. "	Otitis media acuta dextra.	"	+	Small perf.	Neg.	+	0	20	50	25	50	0.5M.
No. 19 S. M. left.	Auditory nerve degeneration	Normal	+	Neg.	Slight retraction at time of test	0	0	40	24	75	40	7M.
No. 20 A. Z. Lat.	Lateral of, media acuta.	Diminished	—	Neg.	Dull	0	0	15	15	30	25	200m.
No. 21 A. Z. Lat.	Auditory nerve degeneration.	"	+	Neg.	Neg.	0	0	40	40	40	40	6M.
No. 22 H. H. Lat.	Tubal catarrh.	Increased	+	Neg.	Red long.	0	+	38	30	38	30	6M.
No. 23 M. T. Lat.	Otitis media acuta dextra.	Normal	+	Both retracted	0	0	35	22	45	45	4M.	4M.
No. 24 M. T. Lat.	Chr. tubal catarrh.	Diminished	+	Neg.	Neg.	0	0	55	25	60	50	7M.
No. 25 A. J. Lat.	Auditory nerve degeneration	Much increased	—	Dull	Dull	0	0	18	12	18	12	200m.
No. 26 R. J. K. Lat.	Chr. tubal catarrh with nerve degeneration left.	Normal	+	"	"	0	0	30	20	30	20	0.6M.
No. 27 M. K. Lat.	Otosclerosis.	A. little increased	+	Slight dullness	0	0	25	18	25	30	100m.	100m.
No. 28 M. L. Lat.	Typical otosclerosis with nerve degeneration.	A little short	+	Dull oration	0	0	20	30	25	35	200m.	1M.
No. 29 M. L. Lat.	Dry perforation left. Auditory nerve degeneration right.	Prolonged	+	After removing resonator heard 8 to 10 seconds longer.	Same dullness	0	0	48	43	48	43	1M.
No. 29 H. P. Lat.	Severe tubal catarrh.	Normal	—	Hearing much improved by catheter.	Normal	0	0	15	20	15	20	200m.
No. 30 B. R. Lat.	Otosclerosis with nerve degeneration.	"	+	"	"	0	0	15	20	15	20	200m.

Name	Sex	Age	Diagnosis	Weber	Schwabach	Rinne	Drum	Supra- aural	an fork via air	Resonator in seconds	Whispered voice
				r. l.	r. l.	r. l.	r. l.	r. l.	r. l.	r. l.	r. l.
No. 31	M.	31				+	+				
No. 32	F.	32		Not lat.	"	+	+				
No. 33	M.	33	Cerumen.	Not lat.	Shortened	+	+				
No. 34	F.	34	Nerve degeneration left.			+	+				
No. 35	M.	35	Tubal catarrh left.	"	Normal	+	+				
No. 36	F.	36	Otitis media acuta dextra.	Lat. to right	Moderately shortened	—	+				
No. 37	M.	37	Tubal catarrh with auditory left.	Lat. to left	Shortened	+	—				
No. 38	F.	38	Cerumen especially right.	Lat. to right	Normal	+	+				
No. 39	M.	39	Acute tubal catarrh left.	Lat. to left	"	+	+				
No. 40	F.	40	Some nerve degeneration and tubal catarrh left.	Not lat.	"	+	+				
No. 41	M.	41	Auditory nerve degeneration left.	Lat. to right	Shortened	+	+				
No. 42	F.	42	Severe nerve degeneration left following parotiditis.	Lat. to left	"	+	+				
No. 43	M.	43	Otitis media acuta sinistra.	"	Lengthened	—	—				
No. 44	F.	44	Normal ears.	Not lat.	Somewhat shortened	+	+				
No. 45	M.	45	"	"	"	+	+				
No. 46	F.	46	"	"	"	+	+				
No. 47	M.	47	"	"	"	+	+				
No. 48	F.	48	"	"	"	+	+				
No. 49	M.	49	"	"	"	+	+				
No. 50	F.	50	"	"	"	+	+				
No. 51	M.	51	"	"	"	+	+				
No. 52	F.	52	"	"	"	+	+				
No. 53	M.	53	"	"	"	+	+				
No. 54	F.	54	"	"	"	+	+				
No. 55	M.	55	"	"	"	+	+				
No. 56	F.	56	"	"	"	+	+				
No. 57	M.	57	"	"	"	+	+				
No. 58	F.	58	"	"	"	+	+				
No. 59	M.	59	"	"	"	+	+				
No. 60	F.	60	"	"	"	+	+				
No. 61	M.	61	"	"	"	+	+				
No. 62	F.	62	"	"	"	+	+				
No. 63	M.	63	"	"	"	+	+				
No. 64	F.	64	"	"	"	+	+				
No. 65	M.	65	"	"	"	+	+				
No. 66	F.	66	"	"	"	+	+				
No. 67	M.	67	"	"	"	+	+				
No. 68	F.	68	"	"	"	+	+				
No. 69	M.	69	"	"	"	+	+				
No. 70	F.	70	"	"	"	+	+				
No. 71	M.	71	"	"	"	+	+				
No. 72	F.	72	"	"	"	+	+				
No. 73	M.	73	"	"	"	+	+				
No. 74	F.	74	"	"	"	+	+				
No. 75	M.	75	"	"	"	+	+				
No. 76	F.	76	"	"	"	+	+				
No. 77	M.	77	"	"	"	+	+				
No. 78	F.	78	"	"	"	+	+				
No. 79	M.	79	"	"	"	+	+				
No. 80	F.	80	"	"	"	+	+				
No. 81	M.	81	"	"	"	+	+				
No. 82	F.	82	"	"	"	+	+				
No. 83	M.	83	"	"	"	+	+				
No. 84	F.	84	"	"	"	+	+				
No. 85	M.	85	"	"	"	+	+				
No. 86	F.	86	"	"	"	+	+				
No. 87	M.	87	"	"	"	+	+				
No. 88	F.	88	"	"	"	+	+				
No. 89	M.	89	"	"	"	+	+				
No. 90	F.	90	"	"	"	+	+				
No. 91	M.	91	"	"	"	+	+				
No. 92	F.	92	"	"	"	+	+				
No. 93	M.	93	"	"	"	+	+				
No. 94	F.	94	"	"	"	+	+				
No. 95	M.	95	"	"	"	+	+				
No. 96	F.	96	"	"	"	+	+				
No. 97	M.	97	"	"	"	+	+				
No. 98	F.	98	"	"	"	+	+				
No. 99	M.	99	"	"	"	+	+				
No. 100	F.	100	"	"	"	+	+				

No. 45	"	"	"	+	+	"	0	0	45	35	70	75	6M.
S. P.	"	"	"	+	+	"	"	"	"	"	Inc.	"	6M.
M., 29	"	"	"	—	+	Cloudy	0	0	25	35	30	35	1M.
No. 46	"	"	"	+	+	Neg.	0	0	40	45	Inc. Same	"	6M.
S. G.	"	"	"	+	+	Neg.	0	0	35	45	45	50	7M.
No. 47	"	"	"	+	+	Neg.	0	0	35	35	Inc.	"	7M.
S. A.	"	"	"	+	+	Dull	0	0	35	35	48	40	7M.
M., 28	"	"	"	—	—	Large perfora-	+	0	30	25	45	40	5M.
No. 48	"	"	"	+	+	tions	0	0	35	28	35	28	0.5M.
S. G.	"	"	"	+	+	Some dullness	"	"	"	"	"	"	"
M., 23	"	"	"	—	—	"	"	"	"	"	"	"	"
No. 49	"	"	"	—	—	"	"	"	"	"	"	"	"
M., 42	"	"	"	+	+	"	"	"	"	"	"	"	"
No. 50	"	"	"	+	+	"	"	"	"	"	"	"	"
R. Z.	"	"	"	+	+	"	"	"	"	"	"	"	"
F., 27	"	"	"	+	+	"	"	"	"	"	"	"	"

ANALYSIS.

Series I.—Cases in which the fork was heard by *both ears* with resonator when no longer appreciated by air conduction:

Diagnosis	Increases in Seconds		Pct. of Increase
No. 1. Auditory nerve degeneration	r. 15 to	45=30	200
	l. 18 "	40=22	22
No. 2. Recurrent otitis media (now healed)	r. 50 "	65=15	30
	l. 37 "	60=23	62
No. 3. Normal ears.....	r. 50 "	65=15	30
	l. 40 "	60=20	50
No. 4. Normal ears.....	r. 47 "	75=28	59
	l. 45 "	65=20	44
No. 5. Normal ears.....	r. 45 "	73=28	62
	l. 44 "	70=26	59
No. 6. Normal ears.....	r. 48 "	75=27	56
(Musician)	l. 58 "	100=42	72
No. 7. Normal ears.....	r. 40 "	83=43	107
	l. 50 "	90=40	80
No. 8. Normal ears.....	r. 55 "	92=37	67
	l. 45 "	82=37	82
No. 9. Normal ears.....	r. 50 "	76=26	50
	l. 35 "	70=35	100
No. 10. Normal ears.....	r. 35 "	62=27	77
	l. 45 "	68=23	51
No. 11. Normal ears.....	r. 55 "	83=28	50
	l. 54 "	105=51	94
No. 12. Normal ears.....	r. 54 "	75=21	38
	l. 60 "	76=16	26
No. 13. Normal ears.....	r. 43 "	55=12	28
	l. 44 "	80=36	82
No. 14. Otitis media acuta sin. Right ear normal.....	r. 35 "	50=15	43
	l. 0 "	10=10
No. 16. Otitis media chronica sin.	r. 30 "	40=10	33
	l. 25 "	30= 5	20
No. 19. Aud. nerve degen. left, with later otitis media acuta	r. 40 "	75=35	87
	l. 24 "	40=16	67
No. 20. Auditory nerve degeneration	r. 15 "	30=15	100
	l. 15 "	25=10	67
No. 23. Chronic tubal catarrh.....	r. 35 "	45=10	28
	l. 22 "	45=23	105
No. 24. Auditory nerve degeneration left.....	r. 55 "	60= 5	9
	l. 25 "	50=25	100
No. 28. Dry perforation left drum membrane. Nerve degeneration right. Cerumen.....	r. 20 "	25= 5	25
	l. 30 "	35= 5	16

(After removal of cerumen, resonator heard 8 to 10 seconds longer.)

Diagnosis	Increases in Seconds		Pct. of Increase
No. 35. Tubal catarrh with nerve degen. left.....	r. 30 to	45=15	50
	l. 20 "	38=18	90
No. 43. Normal ears.....	r. 40 "	50=10	25
	l. 35 "	40= 5	15
No. 44. Normal ears.....	r. 35 "	45=10	28
	l. 35 "	40= 5	15
No. 45. Normal ears.....	r. 45 "	70=25	56
	l. 35 "	70=40	115
No. 47. Cerumen right. Otherwise normal ears.....	r. 40 "	45= 5	12
	l. 45 "	50= 5	11
No. 84. Ears normal. Otalgia probably from teeth....	r. 35 "	48=13	37
	l. 35 "	40= 5	15
No. 49. Otitis media chron. bilat.; dry on left side	r. 30 "	45=15	50
	l. 25 "	40=60	60

TOTAL: 27 cases.

Average seconds **increase** for 54 ears 20.4 second.

Average percentage of increase..... 54.7

Series II.—Cases in which hearing in *one* ear *increased* with resonator and *not* increased in other ear:

No. 15. Cerumen. Otherwise negative	r. 40 to	45 Inc. 5 sec.	12
	l. 40 "	40 No change	
No. 18. Otitis media acuta dextra	r. 20 "	25 Inc. 5 sec.	25
	l. 50 "	50 Same	
No. 27. A typical otosclerosis with nerve degenerat'n	r. 25 "	25 Same	
	l. 18 "	30 Inc. 12 sec.	67
No. 32. Nerve degeneration left	r. 30 "	30 Inc. 8 sec.	27
	l. 30 "	30 Same	
No. 34. Otitis media acuta dextra	r. 10 "	22 Inc. 12 sec.	120
	l. 45 "	45 Same	
No. 41. Otitis media acuta sinistra	r. 50 "	50 Same	
	l. 18 "	30 Inc. 12 sec.	67
No. 42. Normal ears.....	r. 40 "	40	
	l. 35 "	45 Inc. 10 sec.	29
No. 46. Otitis externa and otitis media non-suppurativa dextra.....	r. 25 "	30 Inc. 5 sec.	20
	l. 35 "	35 Same	

TOTAL: 8 cases showing increase with resonator.

Average increase in 8 ears..... 8.5 second

Average percentage of increase..... 45.9

GRAND TOTAL AVERAGES:

SERIES I, 54 ears and

SERIES II, 8 ears

Increase 18.7

Percentage of increase..... 53.5

Series III.—Cases in which hearing is not increased in ear with resonator after being no longer appreciated by air:

No. 17. Otitis media chronica dextra.....	r. 30	l. 60
No. 21. Tubal catarrh with beginning nerve degeneration (?)	r. 40	l. 40
No. 22. Otitis media acuta sinistra.....	r. 38	l. 30
No. 25. Otosclerosis	r. 18—	l. 12
No. 26. Chr. tubal catarrh with nerve degen. left.....	r. 30	l. 20
No. 29. Severe tubal catarrh.....	r. 48	l. 43
No. 30. Otosclerosis with nerve degeneration.....	r. 15	l. 20
No. 31. Cerumen	r. 33	l. 55
N. B. After cerumen removed resonator heard.....	r. 42	l. 55
No. 33. Acute tubal catarrh left.....	r. 35	l. 32
No. 36. Cerumen especially right.....	r. 38	l. 38
No. 37. Acute tubal catarrh left.....	r. 40	l. 45
No. 38. Some nerve degen. and tubal catarrh left.....	r. 40	l. 25
No. 39. Auditory nerve degeneration left.....	r. 55	l. 35
No. 40. Severe nerve degeneration left following parotiditis	r. 48	l. 12
No. 50. Auditory nerve degeneration.....	r. 35	l. 28
TOTAL: 15 cases. =		

RESUME OF ANALYSIS.

With reference to their response to the resonator, the cases studied fall into two main groups.

1. Thirty-five cases in which one or both ears show increased hearing of the a^1 fork on using the resonator.

2. Fifteen cases in which the resonator failed to increase the hearing at all.

Group I. Hearing of the fork was increased by the resonator in 18 cases (Nos. 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 43, 44, 45, 47, 48, 15 and 42), representing 34 normal ears (in cases 15 and 42 only one ear was influenced by the resonator), the average increase being 23 seconds, and the average percentage of increase being 52.

There were seven cases showing auditory nerve degeneration; of these, both ears involved in 2 cases (Nos. 1 and 20), only one ear in 5 cases (19, 24, 27, 28, 35), representing altogether 9 ears thus affected, and the latter showed an average increase of 17 seconds and an average percentage of increase of 82.

There were 5 cases of otitis media (Nos. 14, 18, 34, 41, 46), acuta unilateralis, i. e., 5 ears showing an average increase of 8.4 seconds, and a percentage of increase of 66.

(N. B.—In case 14 the percentage value is arbitrarily set at 100 for convenience.) Two cases of otitis media chronica (Nos. 16 and 49), representing 3 ears, with an average increase of 11.6 seconds and an average percentage of increase of 43.3. Two cases of chronic tubal catarrh (Nos. 23 and 35), representing 3 ears with an average increase of 16 seconds and average percentage of increase of 61. There was one ear (No. 28) with dry perforation showing an increase in hearing of 5 seconds or a percentage of 16. There was also one case of healed bilateral recurrent otitis media acuta (No. 2) which showed an average in both ears of 19 seconds increase and a percentage of 46.

Group 2. Among the 15 cases in which hearing was not increased by the resonator were otosclerosis (Nos. 25 and 30), otitis media acuta (No. 22), otitis media chronica (No. 17), acute tubal catarrh (Nos. 33 and 37), chronic tubal catarrh (Nos. 21, 26 and 29), auditory nerve degeneration (Nos. 38, 39, 40 and 50), and cerumen (Nos. 31 and 36). In case (31) after removal of the cerumen the resonator caused an increase in hearing of 10 seconds.

From this resumé it will be seen that in all of the normal cases the hearing was considerably increased by means of the resonator, namely, 23 seconds or a percentage of increase of 52. It seems strange, however, that some cases of auditory nerve degeneration show improvement with the resonator and others do not; this fact is also noted with reference to acute and chronic otitis media, as well as chronic tubal catarrh. Is it possible that the degree of involvement determines the phenomena or is it some other factor? Only the study of many cases may throw light upon this question, for we find among the nerve cases some with very marked degeneration, others with only moderate involvement, and yet the reaction to the resonator is about the same.

The cases of otosclerosis showed no improvement with the resonator. One instance of cerumen (No. 31), in which the hearing was influenced by the resonator, showed considerable increase after the cerumen was removed. In two other cases (Nos. 15 and 28), in which the resonator improved the hearing despite the cerumen, the improvement was still greater after cleaning the external auditory canals.

CONCLUSIONS.

1. The hearing by air conduction of the a^1 fork (435 v. d.) was considerably increased by means of the properly attuned resonator, at least in all the normal ears examined.

2. Cases of auditory nerve degeneration, or of certain middle ear affections showed in some instances an increase in hearing, and in some no change, with the resonator.

3. It is easy with the resonator to test the actual duration of vibration of various forks.

4. In determining the presence of complete deafness for certain tones resonators will be of great aid. When a fork, especially one whose pitch lies in the "speech area," is not heard at all when reinforced by the resonator, the hearing for that tone can be said to be entirely absent.

5. It may be possible to determine the pitch of a tinnitus aurium from the patient's own observations when the resonator is attuned to various sounds in the surrounding air.

6. While tests with the resonator indicate that its use may have some significance, to really decide its actual clinical value, if any, in otology such as an aid to diagnosis, etc., will require extensive further investigation.

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XL.

NONSUPPURATIVE NEUROLABYRINTHITIS, WITH
SPECIAL REFERENCE TO FOCAL INFECTION
AND SYPHILIS AS CAUSATIVE FACTORS.*

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NEW YORK.

The tremendous advance, during the past decade, in our knowledge of functional examination of the labyrinth, has been of inestimable value in the diagnosis of obscure pathologic conditions arising from this important organ. At the start our attention was largely focused upon suppurative labyrinthine diseases and their complications. More recently, however, increasing thought and attention have been directed to the study and investigation of the nonsuppurative types of disease, conditions for which the term nonsuppurative neurolabyrinthitis is more applicable. By means of a thorough functional examination, a study of a series of those cases which present the most common problem—that is, cases of chronic middle ear catarrh, will almost invariably elicit findings diagnostic of otitis interna or neurolabyrinthitis, in not a small proportion of the total. A diagnosis of neurolabyrinthitis having been established, the problem with which we are next confronted, before appropriate therapeutic measures can be instituted and a reasonable prognosis given, is to determine the etiologic factor or factors which are the basis for the diseased condition.

In this article I shall confine myself to the cases of neurolabyrinthitis due to syphilis and those cases the origin of which is obscure and often difficult to determine—that is, those for which, in all probability, some form of focal infection can be assigned. In order to obtain an insight as to the extent of the possible causative factors of nonsuppurative neurolabyrinthitis, I shall give the comprehensive classification of G. Alexander.

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Consideration of syphilitic neurolabyrinthitis is purposely omitted by Alexander in his splendid paper, and no reference whatever is made by him directly to focal infection as a factor.

According to Alexander, nonsuppurative labyrinthitis embraces the following:

A. Congenital labyrinthine anomalies and diseased conditions arising during embryonal development.

B. Postembryonal labyrinthine disease.

Group A includes:

1. Congenital labyrinthine deafness.
2. Congenital labyrinthine deafness involving the static labyrinth (rare).
3. Progressive labyrinthine deafness occurring in juveniles.
4. Congenital deafmutism.
5. Congenital labyrinthine diseases occurring in cretins.

Group B includes:

I. Primary cases (those affecting inner ear directly, either from external conditions or general diseases).

II. Secondary cases includes those which follow middle ear affections.

I. Primary cases:

1. Traumatic diseases of inner ear (acute).
2. Traumatic diseases of inner ear (chronic), occupational.
3. Metabolic and constitutional diseases causing inner ear disease, such as gout, diabetes, rachitis, endemic cretinism.
4. Diseases of the blood or blood forming organs—
anemia, chlorosis, pernicious anemia, hemorrhagic diatheses.
5. Diseases of the arterial system.
6. Nephritis.
7. Toxic conditions: quinin, salicylates, arsenic, alcohol, nicotin, radium.
8. The infections (nonsuppurative) diseases of the inner ear—scarlet, measles, diphtheria, cerebrospinal

meningitis, pertussis, -mumps, typhoid, erysipelas, rheumatism.

9. Chronic infectious diseases: syphilis and tuberculosis.

10. Disease of the brain and spinal cord: acoustic tumor, dural tumors, brain tumors, acute and chronic hydrocephalus, tabes, multiple sclerosis.

II. Secondary: Nonsuppurative inner ear disease following

1. Chronic middle ear suppuration.

2. Chronic adhesive process in middle ear.

3. Otosclerosis.

This classification, while thorough and comprehensive, may in a measure be considered rather didactic, in parts at least, because of the extreme rarity and problematical nature of some of the conditions referred to as causes for the disease in question.

Considered from a practical standpoint, in a larger majority of instances the disease is due to syphilis in the secondary or tertiary stages or as early evidence of a parasyphilitic condition. Hereditary cases are not common. In taking a history of the cause of noninflammatory labyrinthine disease some damaging influence can be discovered, often dating back a considerable time.

The first manifestations may be preceded by a history of continued abuse of alcohol or tobacco, ptomaine poisoning, long and persistent use of quinin and salicylates, or there may be a history of occupation exposing the patient to loud noises. A general infectious disease, as syphilis, influenza or typhoid, may be the etiologic factor. I. Friesner has recently seen a series of atypical cases of lethargic encephalitis in which the acoustic and static functions were decidedly impaired. In a number of these cases the vestibular function was more markedly involved. He has, as yet, not published these cases. Infectious diseases of childhood are often mentioned, and of these mumps is the most common. Secondary degenerative changes in the labyrinth not uncommonly occur during the course of chronic middle ear suppuration, chronic adhesive process in the middle ear and otosclerosis.

According to observations of Shambaugh and others, a group of cases of labyrinthine disease can be recognized in patients

who are free from middle ear disease and no history of general disease to account for the labyrinth involvement.

According to I. H. Jones, the toxemia affecting the inner ear may be grouped into two classes:

A. Evanescent toxemias, which had produced no degeneration in the inner ear and its intracranial pathways.

B. Toxemias which produced definite impairment in the ear and its pathways. These toxemias result from such powerful toxins as those of mumps or syphilis, and milder toxins, such as those from the gastrointestinal tract or from focal infection.

These toxemias may result either in slow degenerative changes within the labyrinth or eighth nerve, producing attacks of vertigo from time to time, with gradual impairment of hearing. In some of these cases symptoms are limited to disturbances in the cochlea or to vestibular apparatus alone, while in many cases there is complete interference with the labyrinthine function.

F. P. Emerson similarly regards these cases of nerve deafness of nonspecific origin as due to toxemia or low grade infection from a definite focus; and that the primary focus in such cases is usually constant for the individual, as indicated by the location of exacerbations. Billings, Hunter and many other investigators have shown bacteriologically that focal processes in the teeth, tonsils or sinuses are responsible for a low grade of infection of adjacent tissues, and that during acute exacerbations this might extend by continuity or directly by way of the blood stream or lymphatics to neighboring or remote organs. In many cases, where the tonsils are the active cause of deafness, free pus can be demonstrated on one or both sides, especially in cases showing toxemia. This is really an enclosed abscess of streptococcic origin and subject to repeated acute exacerbation. The toxemia is marked and probably the cause of chronic degenerative change in the auditory nerve and its ending in the organ of Corti.

Ménière was first to associate attacks of vertigo, when combined with deafness and tinnitus, with diseases of the inner ear. He believed that the disturbance was the result of hemorrhage into the labyrinth. The assumption was that where distinct periodic attacks occurred, repeated hemorrhages into

the labyrinth was the cause of the condition. It is now known that such an occurrence is rather uncommon, most of the cases of genuine Ménière's disease reported being associated with leukemia. A single hemorrhage into the labyrinth is responsible for the labyrinthine symptoms occurring during this comparatively rare disease.

Recent investigations have shown that chronic arthritis and neuritis, chronic cardiovascular degeneration and chronic nephritis are frequently the result of chronic latent foci of infection. According to Shambaugh, the course of these diseases gives evidence of a chronic progressive character, punctuated, as a rule, from time to time, by acute exacerbations, which are accounted for by a fresh shower of bacteria discharged from time to time into the circulation from the infected focus.

To account for the phenomena observed in many of these cases of internal ear disease as a result of focal infection, we have only to assume that the ending of the eighth nerve may be the structure peculiarly susceptible to bacteria liberated from the infected focus. With each acute exacerbation of inflammatory reaction in the focus, a sudden depression of function results either in the cochlea or vestibular nerve ending, separately or, if both are simultaneously affected, there results a complete picture of Ménière's symptom complex—that is, deafness and tinnitus with vertigo.

As a rule only partial suppression of function results from a single attack, so that deafness as well as tinnitus are most marked immediately following that attack. The vertigo usually disappears rather promptly after a few days or weeks. In these cases of partial suppression of function, there will very likely be subsequent attacks, provided the focus of infection persists. In some cases the attacks of Ménière's symptom complex persists at irregular intervals over several years, associated with an increasing loss of function, the attacks ceasing only after the function of the labyrinth has been entirely destroyed. Occasionally a single attack or a few attacks may be followed by one severe enough to produce total permanent suppression of function in the affected labyrinth.

The vertigo in such cases will be very severe because of the complete unilateral suppression of labyrinthine function, but

it will gradually disappear as the normal labyrinth adapts itself to the changed condition and as soon as other special organs are called into play. No further attacks occur unless the other ear should later become involved. Shambaugh very correctly states the problem in the following manner: "With the conception that the internal ear may be the target for systemic infection of focal origin, we have at once a plausible explanation not alone for the chronic progressive character of the nerve degeneration going on in the labyrinth, but also for the apoplectiform attacks with which these degenerative changes are prone to be punctuated."

That labyrinth cases of obscure origin may be caused by focal infection cannot be denied. It is, therefore, necessary in examining such cases to make a careful search for foci of infection just as we are in the habit of doing in cases of rheumatism and allied conditions.

In recent years an extensive literature has sprung up upon the subject of auditory neuritis of syphilitic origin. Interest in the subject has been especially intensified by the assertion of not a few prominent aurists, here and abroad, that the advent of salvarsan was responsible for the large number of cases reported. The reports of marked increase in frequency of the cases which is claimed to have resulted from the use of salvarsan has undoubtedly been exaggerated, as demonstrated by a study of the literature of cases of acoustic nerve paralysis before the use of salvarsan. O. Mayer reported 55 cases of auditory neuritis due to syphilis, 30 occurring within the first year in the secondary stage and 10 cases within three weeks of the primary lesion.

Wintermute reported observations of Benario, who had collected a series of 210 cases of general neuritis following the use of salvarsan and 121 following the use of mercury. Of the 210 cases, 79 were of the acoustic nerve, and of the 121 the acoustic was involved 46 times. From this observation he concluded that the frequency of auditory neuritis was no greater from the use of salvarsan than from mercury. In 17 cases other cranial nerves were affected besides the eighth.

Gerber distinguished the effect of salvarsan upon the eighth nerve which occurs within a few hours or days after infection from that due to true neurorecurrences, which ordinarily do

not appear before two or three months after the injection of salvarsan, the former being regarded similar to the Herxhimer skin reaction. These early changes following salvarsan injection are due to pressure upon the eighth nerve from its swollen sheath, such swelling being caused by the sudden liberation of syphilitic toxins. The present attitude of otologists is that most of the suspected cases of arsenic toxemia are really neurorecurrences of syphilis due to the administration of a dose of salvarsan insufficient to completely destroy the spirochete.

Cases have been frequently reported of neurorecidives following the use of salvarsan which disappeared completely upon repeated injection of the remedy. Mackenzie very properly states the importance to the otologist of this subject in that "the otologist in recognizing the clinical picture of syphilis of the inner ear and eighth nerve bears the same relation to the internist as does the ophthalmologist who recognizes the characteristic retinal changes in nephritis."

The onset of a sudden or rapidly progressive bilateral deafness in a syphilitic patient is not uncommon. The importance of not regarding and treating the condition as an isolated affection of the auditory apparatus becomes apparent, when we realize that the aural disturbance is in reality an early manifestation of an extremely serious condition, syphilitic involvement of the central nervous system. According to Fraser, one-third of the cases of nerve deafness of unexplained origin have a plus Wassermann. When the disease has become latent, the reaction may be negative in about 50 per cent of cases, so that a negative Wassermann cannot be taken as complete proof of the absence of syphilis.

Many cases of deafmutism are in reality due to intrauterine syphilis or the syphilitic changes in the ear occurring before the child has learned to talk. In the absence of any other assignable cause, a primary bilateral labyrinthine or nerve deafness should be regarded with suspicion as due to syphilis and investigated accordingly. In the case of primary unilateral labyrinthine or nerve deafness the contrary holds true, syphilis being rather the exceptional cause.

Because of the insidious character of the infection and the usually somewhat casual nature of the aural examination, the

condition is not infrequently overlooked, so the frequency with which auditory disturbance complicates constitutional syphilis cannot be estimated accurately. In Politzer's book the vague statement is made that from 7 to 48 per cent of cases of syphilis show aural lesions; the latter figure is undoubtedly high. V. Dabney regards 5 per cent as sufficiently near the proper proportion to serve as a guide for study and investigation.

The pathologic data relating to this subject are meager. Considerable discussion has arisen as to the exact location of the lesion in auditory apparatus. The earlier writers were of the opinion that the lesion is in the labyrinth. Gradenigo was the first to differ in this view, his contention being that the lesion was oftener a neuritis of the auditory nerve rather than an affection of the labyrinth. At the present time the consensus of opinion inclines to the view that in the majority of cases of deafness from syphilis the nerve is affected before the labyrinth; that not infrequently the labyrinth does become involved but to a lesser degree. Exceptionally the labyrinth may become involved, while the nerve escapes; such findings are extremely rare.

The pathologic diagnosis has been questioned in such instances because of carelessness on the part of the investigator in failure to report nerve findings and in depending entirely on microscopic appearances. Microscopically the auditory nerve shows degenerative changes of neuritis with atrophy of its end organ; in some instances there is a concomitant involvement of the other cranial nerves, particularly the second, fifth and seventh. M. Nonne was first to draw attention to this coincidence. The all-important statement of Ellis and Swift, convincingly indicated that deafness occurring in the course of syphilis was rarely due to an isolated infection of the eighth nerve or labyrinth, but is generally a manifestation of an involvement of the cerebrospinal system. This view further enlarged our conception of the extent of the disease process. In their opinion the eighth nerve involvement is associated with a basal meningitis, a fact which they emphasized by means of their reference to lumbar puncture findings. They refer to nine cases reported by Knick and Zolozieki, seven of which had a positive Wassermann of spinal fluid, one was negative and in one case no report was given. Cytologic and chemical

findings of the spinal fluid characteristic of meningeal irritation were present.

The prognosis of syphilitic deafness, formerly regarded bad, has been greatly improved by the intraspinal injection of salvarsanized serum suggested by Ellis and Swift. Many early cases of marked impairment of hearing due to syphilis have been decidedly improved by this treatment.

Of all the cranial nerves, none is so vulnerable to the syphilitic infection as the eighth nerve. For this reason it frequently happens that the eighth nerve is first to feel its influence and the otologist is thereby afforded an opportunity to recognize the general character of the disease from the start. In a majority of cases the cochlear branch is affected to a far greater degree than the vestibular. The cochlear and vestibular branches may be simultaneously affected, but as a rule the cochlear branch is first to be involved. While recovery from vestibular symptoms is complete under appropriate treatment, the symptoms due to cochlear involvement, tinnitus and impairment of hearing, are likely to be more or less permanent; a few cases of neuritis of the vestibular nerve alone have been reported. Some patients do not complain of ear symptoms, though it is not difficult to demonstrate the associated aural involvement. A larger number present predominant ear disturbances and in less frequent instances examination of the ear leads to the diagnosis of cerebrospinal disease. It must be remembered that though the cochlear nerve is considered most frequently attacked, a complete examination of these cases shows interference with both cochlear and vestibular functions.

In the majority of cases the first symptom to attract the attention of the patient in whom the cochlear branch is involved is an abrupt onset of tinnitus—usually bilateral—which soon becomes constant, diminishing only as the pathologic changes in the nerve progresses or as the patient responds to thorough treatment. Following this, sudden impairment of hearing, usually very profound in degree, is noticed. No assistance is obtained from the drum picture as it is not affected in any characteristic way, whereas a coincident suppuration or a pre-existing chronic middle ear catarrh may actually obscure the etiology. That mixed conditions, syphilitic involvement of

the inner ear and eighth nerve, combined with chronic catarrhal or suppurative otitis media do exist is accepted by otologists everywhere.

Where reliance is placed mainly upon the history and otoscopic picture pointing to chronic middle ear catarrh, rather than upon functional test findings, the otologist is apt to overlook the inner ear and eighth nerve condition and satisfy himself with a diagnosis merely of the middle ear lesion. In most cases little can be expected of a patient's history. In those cases where the hearing and equilibrium tests show involvement of the inner ear or eighth nerve the Wassermann test should be made. This also obtains in all those cases of middle ear affection where the hearing is found to be reduced below that allowable for uncomplicated middle ear disease and where the suspicion of complications in the inner ear and nerve has been confirmed by tuning fork and vestibular tests. Where the blood Wassermann is negative, in strongly suspicious cases, Wassermann test upon spinal fluid should be made.

If, in addition to cochlear involvement, the vestibular branch is affected, the symptoms to which it gives rise are far more distressing to the patient. Attacks of vertigo, disturbance of equilibrium and sometimes vomiting result. The vertigo is characteristic of the labyrinthine variety, causing subjective sensations of objects revolving about the patient. These attacks, lasting two or three days, are not infrequently varied by intermissions, during which the patient is entirely free from symptoms. Neuritis of the seventh nerve as a concomitant involvement, may be present, manifesting itself as a facial paresis, complete paralysis seldom occurring. At times the facial nerves involvement preceded that of the eighth nerve, in contradiction to inflammatory affections of the labyrinth, in which the paralysis follows or is concomitant with labyrinth symptoms. The extrinsic eye muscles are next in frequency involved. The fifth nerve, seldom affected, produces characteristic parasthesias and anesthasias in the areas of its distribution.

In tabes, Haberman found almost complete degeneration of the cochlear and partial degeneration of the vestibular nerve. The nerves were replaced with connective tissue and

here and there were found distinct signs of neuritis still present. These changes indicate secondary atrophy following a primary neuritis.

The characteristic and diagnostic findings in cases of inner ear or nerve deafness are, as regards the cochlear apparatus, as follows:

Conversation may be heard fairly well, while the watch, acumeter, and especially the Galton whistle, will elicit little if any response. Weber is referred to the better ear. In a unilateral case of pure internal ear disease we observed, in the milder grades, a Rinné positive, but as the deafness increases the character gradually changes until it becomes plus-minus eventually, with absolute deafness, the Rinné becomes negative (infinitive). The reason for the negative Rinné is that the bone conduction is transferred from the sound ear. Usually both ears are affected in syphilis, so that the positive character of the Rinné is accentuated. In testing the complete range of hearing with tuning forks, islands of hearing may be demonstrated. There is a decided shortening of bone conduction. These findings point to a lesion located in the inner ear or its nerve.

In the marked shortening of bone conduction we have one of the most reliable and striking evidences of luetic infection, as it is perhaps a most striking sign, occurring in 95 per cent of cases. A deafness without apparent middle ear trouble showing a positive Rinné should at once arrest the attention of the aurist. There is a marked lowering of the upper tone limits so that high pitched tones are badly heard, low pitched tones are better heard than the high pitched. O. Beck of Vienna is of the opinion that the prolonged bone conduction present in middle ear disease of nonsyphilitic is absent in syphilitic cases. In his opinion, shortening of bone conduction in cases of syphilitic auditory neuritis is present in a large number of cases even in the primary stage before the appearance of general symptoms.

In the opinion of Berens, Friesner, Mackenzie, Jones, Dabney and others the vestibular findings may be of even greater importance in the diagnosis of syphilitic neurolabyrinthitis than the auditory tests. Especially characteristic of these findings are the apparent inconsistency and irregularity

of the reactions and the confused and variable findings from day to day. Among the vestibular findings especially suggestive of syphilis are a progressive reduction of vestibular irritability, or a reduction remaining constant in presence of other evidence of syphilis.

I. H. Jones regards the recognition of progressive impairment of vestibular function from day to day, as demonstrated by repeated tests, evidence of an active toxemia. This strongly suggests syphilis, especially in the presence of a suspicious initial lesion which cannot be accounted for definitely. In such affections as mumps, scarlet fever, diphtheria, gastrointestinal toxemias, etc., where the inner ear or eighth nerve had been previously involved, the resulting impairment is constant. Graham and others regard the absence of turning reaction with caloric reaction present or vice versa, quite characteristic. The same may be said of irregularities in reaction between the vertical and horizontal canals and the presence of vertigo without nystagmus, or exaggerated after-turning or caloric nystagmus without vertigo.

The presence of a spontaneous rhythmic nystagmus when looking straight ahead is more than presumptive evidence of a lesion in the static labyrinth or vestibular nerve. Characteristic of inner ear or eighth nerve lesion involving the vestibular branch, there occurs a rhythmic nystagmus to the side opposite the lesion if one side alone is affected, or to the side of the lesser loss if both sides are involved. Alexander and Barany have observed a characteristic fistula symptom at times in cases of auditory neuritis of syphilitic origin, particularly in the hereditary form. They ascribe this to an extreme static irritability in the earlier stages.

It has long been recognized that when the inner ear is destroyed from any cause, the eighth nerve continues to react to electrical stimulation; if the eighth nerve is destroyed no amount of current strength, even up to 20 ma., will produce nystagmus. The galvanic test is applied as follows: With the cathode in contact with the tragus of the tested ear and the anode held in the patient's hand, there results a rotary nystagmus towards the tested ear. When the anode or positive pole is in contact with the tested ear, a rotary nystagmus in the direction of the opposite ear follows. A current strength of

4 ma. should induce the reaction if the nerve and its ending are intact. Alexander and Mackenzie regard a current strength of more than 4 ma., i. e., 6 to 15 ma., to induce a reaction evidence of diminished vestibular irritability. With complete degeneration of the nerve the reaction is entirely absent. Mackenzie, in the *Laryngoscope* of June, 1916, reported a case of specific auditory neuritis in which, by means of repeated galvanic tests, he was able to note the difference in intensity of the pathologic process in the auditory nerve, from hypersensitiveness in the first test (3.5 ma.) to diminution and almost complete suppression of function in a later test (8 ma.).

In hereditary tertiary lues, defective hearing is frequent. The onset is usually rapid and bilateral, with or without vertigo. The condition develops most frequently in the second or third year of life, less frequently later and only exceptionally after the twentieth year. There are the accompanying signs constituting Hutchinson's triad—keratitis and Hutchinson's teeth. Ulcerations or scars of the nose, throat and skin may be present. The keratitis nearly always precedes the ear lesions by weeks or days, though it may develop simultaneously with it. The presence of a beginning keratitis is, therefore, not only diagnostic of an aural condition impending or actually active, but a warning as well that treatment started at this time may heal, partially at least, an aural lesion. The prognosis of hereditary luetic deafness is bad, despite the use of specific treatment; complete deafness results as a rule. Autopsy findings in a number of these cases have disclosed destruction and replacement of the labyrinth and the internal auditory meatus with bone.

Of a series of forty-five cases of otitis interna recently studied by me, most of them in the service of Dr. T. P. Berens, Manhattan Eye, Ear and Throat Hospital, ten were definitely classified as of syphilitic origin. Many presented themselves with no other complaint than impaired hearing and tinnitus. Some, at various times, had had attacks of vertigo. Particularly instructive is the fact that the diagnosis of neurolabyrinthitis would have been overlooked if careful tuning fork tests, labyrinthine examination and Wassermann reactions had not previously been made. In many of our crowded clinics these cases are not infrequently diagnosed chronic catarrhal

otitis media from otoscopic findings and the history of impaired hearing. In one case (No. 1) further physical examination—reflexes, pupillary reaction, etc.—established a diagnosis of early tabes. Mild attacks of dizziness and slightly impaired hearing had been the only complaint in this case, the real condition having been unrecognized. He had been treated for O. M. C. C. for a period of two years. Of the thirty-five non-specific cases the causes discovered in a majority were: long continued use of quinin, noisy occupation, mumps, trauma, cerebrospinal meningitis and advanced middle ear catarrh. In quite a number no definite cause could be assigned. The question of latent syphilis must still be considered and the possibility of focal infection or some metabolic disturbance in the light of our present knowledge, is not to be overlooked.

Tuning forks used in these tests: C (64 D. V.), C (128), C₄ (2048). A—air conduction. M—mastoid.

Case I.—J. W. V., Male, age 48 years, came to the Manhattan Eye, Ear and Throat Hospital, complaining of constant tinnitus of long duration and defective hearing. During the past year he has had repeated mild attacks of vertigo and nausea. The only treatment he had received was catheterization of the eustachian tube. History of syphilitic infection 26 years ago. Thorough antisyphilitic treatment for a few years. Had received five injections of salvarsan one year ago.

Otoscopical picture: Slight retraction and dullness both drums. Eustachian tubes patent.

Right ear	Whisper	Left ear
10 ft.	to the right	5 ft.
Laterallizes		
cA—11 sec.		cA—5 sec.
cM—4 sec.		cM—3 sec.
c4—A—3 sec.		c4—A—3 sec.
64 D. V. Plus		64 D. V. Plus

Turning to the right=Nystagmus (horizontal) to the left 10 sec. Turning to the left=Nystagmus (horizontal) to right 16 sec.

Caloric (cold water) right ear=Nystagmus (rotary) to the left after 1½ min. Caloric (cold water) left ear=Nystagmus (rotary) to the right after 4 min.

Pupils: Unequal. Right pupil Argyle-Robertson. Left

pupil only slight reaction to light. Reacts to accommodation. Knee-jerks diminished.

Romberg present. Wasserman (blood) 4+.

The patient went to the Neurological Institution for treatment. This case of tabes had been treated at various clinics during a period of two years for chronic middle ear catarrh.

The tuning forks used in testing these cases were the following: C (64D.V.), C (128), C₄ (2048). A=air. M=mastoid.

Case II.—P. W., Female, 40 years, admitted to the clinic complaining of impaired hearing and tinnitus in both ears for one year. No family history of deafness. Frequent attacks of dizziness lasting a few minutes. No symptoms or signs referable to syphilitic infection. Otoscopic picture that of chronic middle ear catarrh. Wassermann 4 +.

Functional examination:

Right ear	Voice	Left ear
No hearing	Laterallizes	15 ft.
cA = 0		cA = 10
cM = 4 sec.		cM = 6
c4 = 0		c4A = 4 sec.
64 D. V. Minus		64 D. V. minus

Noise apparatus in left ear; does not hear loud shouting in right.

Caloric right ear=Fine rotary nystagmus to left after 4 min. Caloric left ear=Coarse rotary nystagmus after 2 min.

Case III.—S. I.—Male, age 50 years, came to me complaining of tinnitus and defective hearing extending over many years. During this time his treatment had consisted of catheterization of eustachian tubes. Complained also of attacks of dizziness. History of syphilitic infection 25 years ago for which he had received two years of careful treatment. Wassermann negative.

Otoscopic examination—Drums, dull and retracted; short processes and posterior folds prominent; light reflexes incomplete.

Right ear		Left ear
12 ft.		5 ft.
cA = 7	Does not lateralize	cA = 5
cM = 3	Whisper	cM = 3
c4 = 4		c4 = 5
64 D. V. Plus		64 D. V. Plus

Turning to the right=(horizontal) nystagmus to left 15 sec. Turning to the left=(horizontal) nystagmus to right 10 sec.

Caloric (left)=rotary nystagmus to the right after 5 min. Caloric (right)=rotary nystagmus to the left after 4 min.

Pupils: Knee jerks, normal. No Romberg.

Under specific treatment attacks of dizziness and tinnitus lessened and finally ceased. Hearing, practically no change; tuning fork tests about same as above.

Case IV.—Traumatic labyrinthitis (unilateral).

D. S., Male, age 24 years, came to the hospital complaining of defective hearing, left ear; two years duration. No tinnitus. History of fracture of skull three years ago; hearing defective since then. Discharge of blood from the left ear at the time of injury. No history of syphilis. Otoscopic examination negative.

Right ear 20 ft.	Whisper Lateralizes	Left ear 0
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Noise apparatus in right ear; hearing absent in left ear on loud shouting. Normal hearing left ear.

Caloric (cold water)—Left ear negative as to nystagmus after 5 min. Caloric (cold water)—Right ear, rotary nystagmus after 40 min.

Case V.—M. L., age 40 years. History of defective hearing, tinnitus and fullness left ear. Condition began during a severe influenza attack four months ago.

Otoscopic examination both ears, appearance associated with middle ear catarrh.

Functional ear examination:

Right 20 ft. 20 ft.	Acoumeter Spoken voice Lateralizes	Left 0 0
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Noise apparatus right ear; does not hear loud shouting left ear.

cA = 25 sec. cM = 12 sec. c4 = A. 14 sec. 64 D. V. Plus		cA = 0 cM = 7 sec. c4 = A. 0 64 D. V. Negative
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Turning to right (horizontal)—Nystagmus (rotary) to the left 10 sec. Turning to left (horizontal)—Nystagmus (rotary) to the right 18 sec.

Caloric (cold water) left ear negative after 5 min. Caloric (cold water) right ear after 1 min. fine nystagmus (rotary) to the left.

Base jointing and falling reactions normal.

Wassermann (blood) negative. Spinal Wassermann had not been made.

Case VI.—This case is one of unilateral complete suppression of labyrinth function following an unusually severe attack of influenza.

M. L., Male. Defective hearing and tinnitus of four months' duration, following influenza. History negative otherwise. Otoscopic examination, minor changes of middle ear catarrh, both ears.

Functional ear examination:

Right	Voice	Left
20 ft.		0
cA = 22	Lateralizes	cA = 0
cM = 12		cM = 7 sec.
c4A = 12 sec.		c4A = 0
64 D. V.—		64 D. V.—

Noise apparatus in right ear does not hear loudly spoken noise in left ear.

Right ear caloric (cold water)—Fine nystagmus after 1 min.

Left ear (caloric)—No nystagmus after 5 min. irrigation.

Wassermann (blood) negative. Patient refused lumbar puncture for spinal Wassermann.

Case VIII.—A. M., age 28 years, male. Initial lesion, August, 1914. One month after receiving injection of salvarsan from his physician, patient informed me that his hearing became decidedly impaired. Patient believes that hearing in the left ear had improved, but condition of right ear had shown no change. Had severe attacks of vertigo and nausea at time of sudden impairment of hearing.

Otoscopic picture negative. Does not lateralize.

Noise apparatus in left ear—Does not hear loudly spoken voice. Raised his voice to a high pitch when asked to read while noise apparatus is used in left ear. Acoustic function normal in left ear.

Caloric (cold water) right ear, head 30 deg. forward—Nystagmus (rotary) to left after 3 min. Head backward 60 deg., horizontal nystagmus to the left after 4 min.

Caloric (cold water) left ear, head 30 deg. forward—Nystagmus (rotary) to the right after 2½ min., head backward 60 deg. (horizontal)—Nystagmus to the right after 3 min.

Turning to the right (horizontal)—Nystagmus to the left 18 sec. Turning to the left (horizontal)—Nystagmus to the right 16 sec.

Past pointing and falling normal.

Case VIII.—J. H., referred to me by his physician.

Male, age 45 years, complained of tinnitus and impaired hearing left ear of three months' duration. Occasional attacks of vertigo. No history of syphilis.

Otoscopic examination—Negative.

Functional examination (left ear) showed rinne positive shortened bone conduction. Lowering of upper tone limits. Lateralizes to the right.

Caloric (cold water) head forward 30 deg.—(Rotary) nystagmus to the opposite side in 1 to 1½ min. Caloric (cold water) head backward 60 deg.—Nystagmus (horizontal) to the opposite side in 2 to 2½ min.

Pointing and falling react normal. Despite negative history of syphilis, a Wassermann test was advised. Report returned by Wassermann 4 +. Case was referred back to her physician for treatment. Five injections of salvarsan and 25 injections of mercury were administered. Examination after four months' treatment hearing decidedly improved. Tinnitus still present. Attacks of vertigo have ceased. Two Wassermann reports negative.

Case IX.—Congenital syphilitic neurolabyrinthitis.

L. R., female, age 13 years. Deafness four years and attacks of vertigo. Bilateral keratitis six years. Wassermann 3 +.

Functional ear examination:

cA = 2		cA = 3
cB = 5		cB = 6
c4 = 0		c4 = 0
64 D. V.—		64 D. V.—
Does not lateralize		

The vestibular test showed considerable reduction in after nystagmus after turning to right and left (10; 15 respectively) for horizontal and vertical canals.

Right ear—Caloric (cold water) head forward 30 deg. (rotary) nystagmus to the left after $2\frac{1}{2}$ min.

Left ear—Caloric (cold water) (rotary) nystagmus to right after 3 min.

This case of hereditary neurolabyrinthitis passed from observation.

Case X.—Congenital syphilitic neurolabyrinthitis.

E. T., age 18, male, referred to me June 25th, 1920, by his family physician. Mother infected with syphilis third month of her pregnancy. Physician informed me that child was born with all evidences of syphilis; had hydrocephalus. Antiluetic treatment administered to mother and child. Later sent to an institution and treatment indifferently followed. Had usual diseases of childhood. Mother informed me that until five years ago patient had fairly good hearing. Indefinite history of attacks of vertigo and falling few years ago.

Examination: Well developed young man, rather more robust than those of his age usually are. Marked defect of speech; patient difficult to understand. Hearing for conversation, absent. Markedly impaired vision. Bilateral keratitis and external squint. Hutchinson teeth. Romberg absent; knee jerks diminished.

Left ear drum dull; handle of malleus retracted; short process prominent. Right ear, large perforation of drum; anterior two-thirds defect and suppurating; noise apparatus in right ear, does not hear loudly spoken voices in left. Noise apparatus in left ear, hears loud shouting in right. Patient hears tuning forks 128, 256, in right ear but insufficient to record air or bone conduction. No spontaneous nystagmus. Caloric (cold water) left ear, head erect, to right—Nystagmus after 4 minutes. Head to back 60 degrees—(Horizontal nystagmus) to right after 3 minutes. Caloric (cold water) right ear—(Rotary) nystagmus to the left after $2\frac{1}{2}$ minutes. Head back 60 degrees—(Horizontal) nystagmus to the left after 1 minute. Past pointing and falling normal.

No Romberg; reflexes normal; Wassermann negative. Patient is still under antiluetic treatment by family physician.

SUMMARY.

1. Impaired hearing with apparent middle ear disease showing a positive Rinné should at once arrest the attention of the aurist.

2. Shortening of bone conduction is one of the most constant, reliable and striking evidences of luetic infection. This shortening of bone conduction and, at times, gradual daily impairment of vestibular function, is one of the earliest signs of constitutional syphilis.

3. Recognition of syphilitic auditory neuritis is of paramount importance, as this may be evidence of an incipient cerebrospinal syphilis.

4. Salvarsan, far from causing the continuance or recurrence of syphilitic auditory neuritis, is a means of curing the condition.

5. Prognosis of acquired syphilitic auditory neuritis, while fairly good as to improvement of hearing, should be guarded. Prognosis of the hereditary type is bad.

6. Nonsuppurative neurolabyrinthitis, as a cause of Ménière's symptom complex, may be associated with chronic middle ear catarrh or suppuration. Reliance should, therefore, not be placed upon the history or otoscopic findings, but upon functional ear examinations and laboratory findings.

7. Focal infection or metabolic disorders may be the causative factor in obscure cases of Ménière's symptom complex.

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XLI.

A CASE OF LABYRINTHITIS AND CEREBELLAR ABSCESS.

CHAS. E. PERKINS,

NEW YORK.

R. F., male, nine years old, had suppuration of the right ear since infancy. Entered Dr. Dench's service at St. Luke's Hospital July 20, 1920.

Tests showed hearing in diseased ear for loud whisper 6 ft. Lower tone limit, 90; upper tone limit, normal; vestibular mechanism, active; spinal fluid, normal. No history or symptoms of brain involvement.

On July 22nd I performed the radical mastoid operation with primary skin graft. Thirty-six hours later the patient developed vertigo, marked nystagmus to sound side, vomited and complained of headache. Temperature 101° . Total deafness of operated ear, tested with dressings removed. Douching the ear with cold water did not increase the nystagmus or vertigo, with hot water did not produce nystagmus to the diseased side. Spinal fluid contained 350 cells to the millimeter with high polymorphonuclear percentage. Globulin test strongly positive. Right pupil dilated. Eye grounds practically normal.

Labyrinth operation was done after the Neumann method. There was free flow of cerebrospinal fluid from the internal auditory meatus, also from the cochlear region after the removal of the mediolus.

Improvement took place after this operation and convalescence was apparently becoming established. Headache and fever subsided, nystagmus and vertigo became progressively less. This continued for ten days, when a free purulent discharge from the region of the internal auditory meatus developed. The patient became drowsy, complained of headache and vomited. His spinal fluid contained 20 cells to the cubic millimeter. Globulin test mildly positive, overpointed with

right hand indiscriminately. As I was off service, the subsequent care of the case fell to Dr. Bowers.

Operation August 6th. Sequestrum of bone removed from the region of the internal auditory meatus. This opened an abscess in the cerebellum from which a considerable quantity of pus escaped. Culture of this pus grew the pyocyaneus. An attempt was made to tie off the sinus, in order to obtain more room to evacuate and drain the abscess, but it was unsuccessful on account of hemorrhage, which was controlled with difficulty by packing. The patient showed much improvement after this operation. This continued for eighteen days. Then there was an attack of projectile vomiting. Headache, nystagmus to both sides; overpointed to left with right hand; inequality of pupils, right the larger. These symptoms continued for about a week, when a further attempt was made to locate and drain an intracranial abscess. The temporosphenoidal lobe was explored with negative results. Cerebellum exposed posterior to the sinus and explored with the grooved director. Upon passing this instrument rather deeply into the upper part of the cerebellum, a hard resisting wall was encountered, which at the time was interpreted as the tentorium, but which at autopsy was found to be the thick capsule of an abscess. After this operation there was no improvement. The patient died eight days later.

Autopsy showed meningitis at the base, and "A large abscess, with thick wall, occupying a large portion of the upper two-thirds of the right cerebellar hemisphere, extending to within two centimeters of the posterior pole." Cultures of pus from this abscess grew the pyocyaneus.

This case raises several points to which I will allude briefly:

1. Upon opening the dura at the internal auditory meatus there was a free flow of cerebrospinal fluid. I have come to regard this occurrence as an omen of good augury. It doubtless means that the cerebellopontine cisterna has been opened and when it occurs the active process seems more likely to be localized in this region. At any rate the meningitis in this patient began to improve as shown by the subsidence of the temperature and headache and clearing up of the spinal fluid. The next specimen, taken twelve days later, after cerebellar

symptoms had developed, showed a cell count of 20 with practical disappearance of the globulins.

2. The question arises as to the time of the cerebellar infection. Whether it occurred previous to the radical operation or if after it. Was it present at the time of the labyrinth operation, or did it take place some ten days later when wound infection became evident with pus discharging from the internal auditory meatus? The importance of fixing this date arises from the fact that it gives the length of time during which a brain abscess may form a thick hard capsule. Dr. Bowers, who performed the later operations and was present at the autopsy, believes that it would have been impossible for such an abscess and capsule to form in the forty-eight days intervening between the radical operation and death, but that it was present in a latent form when the patient entered the hospital. However, it seems improbable that an abscess of such size should occupy and more or less destroy a large part of one cerebellar hemisphere and yet produce no symptoms. More likely the cerebellar infection occurred between the labyrinthitis and meningitis and the wound infection. That is, between the 39 and 29 days before capsule was discovered upon exploration. So this would be the length of time in which abscess developed and formed a thick, dense capsule. The part played by the pyocyaneus infection in producing a capsule is to be noted. The pneumococcus is perhaps found more often than any other germ in abscesses with capsules. This observation shows that in so far as the germ determines this condition the pyocyaneus is effective.

3. The inadequacy of the grooved director as an exploring instrument is strikingly shown in this case. The resistance of the capsule was so great that it was believed to be the tentorium. Perhaps a sharp knife would have evacuated the pus. It would seem that a procedure advocated by Ballance, which largely has fallen into disuse in this country, might have resulted in locating the abscess. I refer to digital exploration. The finger surely would have succeeded in making out such a large, firm abscess.

4. Finally, the difficulty of using the sinus area as an approach is shown. The attempt to tie off the sinus as advised by Ballance and independently by Friesner, failed on account

of free hemorrhage, which required packing. There are two objections to this procedure. First, one hesitates to inflict sufficient traumatism to the cerebellum properly to insert the ligatures. Second, the resistance of the dura would interfere with their being tied sufficiently tight to occlude the sinus lumen unless they tear their way through, when bleeding would be very likely to occur. So, while approach through the sinus area is ideal in those cerebellar abscesses following sinus thrombosis and has been utilized by McKernon and others, it is not liable to be of very much use when the blood is freely flowing through a patent sinus.

XLII.

PULSATING SPHENOIDITIS.

HARRY L. POLLOCK, M. D.,

CHICAGO.

In 1916 we had referred to us by an oculist of Milwaukee, a patient in whom a diagnosis of retrobulbar tumor, probably sarcoma, had been made. Inasmuch as this condition is not connected with the subject under discussion this evening, I will not go into details concerning his ocular findings, except to state that we did a Kroenlein operation and found no tumor but a marked cellulitis, which resolved after long continued suppuration. He also had a pansinitis on the same side (left) as his exophthalmos. An ethmoid exenteration was done and the sphenoid opened. As soon as the postoperative reaction had subsided, we noticed a thick, profuse, yellowish discharge from the sphenoid, which persisted for a long time, notwithstanding the usual treatment for this condition. At various times a slight pulsation was noted in the sphenoid. *i.e.*, there was pulsation transmitted to the pus in the cavity. Not having noticed this condition previously, we began to discuss the probable reason for this pulsation. Being synchronous with the heart beat, only one assumption was possible, but just how, why and wherefrom this pulsation arose, was somewhat a conjecture. It could not come direct from the internal carotid, or it would be present all the time. It might possibly be transmitted through the cavernous sinus, and if this were the case, it certainly could be exaggerated by dilating the sinus or causing an increased blood pressure within the cavernous. This, we knew, could be brought about by compressing the return venous flow from the cranial cavity. We compressed both internal jugulars by pressing deeply with both thumbs, and found that the pulsation became more marked and continued as long as the compression ensued and disappeared as promptly as the pressure was removed. After irrigating the sphenoid and allowing some fluid to remain in the cavity, pulsation could be brought about by again com-

pressing the jugulars. We were very much interested in the probable size of the sphenoid and removed the anterior wall and parsethmoidalis down to the floor. To our great surprise, the curved probe could be passed for at least two and one-quarter inches below the opening, the direction being downwards and backwards. On the right side, the probe could be passed only about one-half inch. With a long probe in the sphenoid, no pulsation could be felt, but immediately upon compressing the jugulars, there was a pulsation of the probe which could be observed on the portion extending out of the nose. The Wassermann, which had been made before the Kroenlin operation, proved to be positive. The patient was given intensive antiluetic treatment and kept under observation, and after several months' treatment, the pus discharge abated and finally stopped.

We have had several more cases, almost identical of the above case, and found that they ran about the same course.

That the pulsation was transmitted through the cavernous sinus from the carotid, there can be no doubt, but why in only these few cases and not in all cases of sphenoid suppuration?

We know that the floor of the sphenoid sinus lies just over the body of the sphenoid and that the latter is composed of cancellous bone. There is no doubt that the solid floor of this cavity is necrosed, most probably due to the lues, and the infection thereby affects the cancellous portion of the body of the sphenoid, accounting for the immense depth of this sinus. It is also possible that the carotid takes an anomalous position and passes directly through the sphenoid cavity. My associate, Dr. J. Beck, has a photograph of a specimen which shows the carotid in this position.

Fortunately, all of our patients recovered, so that we were not able to prove postmortem that our deductions were correct. We also know that dehiscences occur in the sphenoid cavity just as in the frontal sinus or other bony cavities, and these might also account for this peculiar and interesting phenomena.

There are other etiologic conditions which may produce pulsation in and around the sphenoid cavity. Aneurysm of the internal carotid and in this region may cause pulsation. We have also had another case in which distinct pulsation could be observed very nicely in the sphenoid. This was in a man

whom a diagnosis of hypopituitarism or Froehlich's disease had been made, in which we suspected a tumor of the hypophysis. We operated transphenoidally and removed the floor of the sella turcica and found a large cyst, which was opened and drained. The patient made an uneventful recovery and has remained well now about seven years. After all post-operative reaction disappeared, we could observe this distinct pulsation, which was the pulsation of the brain. In this case, however, there was no infection or suppuration of the sinus. At that time we did not observe whether a compression of the jugulars would increase the pulsation or not.

Let us study the anatomic relations of the cavernous sinus and the sphenoid and see how easily this phenomena may occur. The following is taken from Gray's Anatomy: "The cavernous sinus is named from presenting a reticulated structure, due to being traversed by numerous interlacing filaments. There are two cavernous sinuses of irregular form, larger behind than in front, and placed one on each side of the sella turcica, extending from the sphenoidal fissure and opening behind into the petrosal sinuses. On the inner wall of each sinus is found the internal carotid artery, accompanied by filaments of the carotid plexus and by the sixth nerve. On its outer wall, by the third, fourth and ophthalmic division of the fifth nerve. These parts are separated from the blood flowing along the sinus by the lining membrane, which is continuous with the inner coat of the veins. The cavernous sinus receives some of the cerebral veins, and also the sphenoparietal sinuses. They communicate with the lateral sinuses by means of the superior and inferior petrosal sinuses, and with the facial veins through the ophthalmic vein. They also communicate with each other by means of the circular sinus."

Thus, we see the upper portion of the sphenoid sinus is practically surrounded by this network of bloody sinuses and in very close proximity of the internal carotid artery. Furthermore, Loeb and others have brought to our attention the various formations and irregularities in the size and position of the sphenoid sinus. It is often prolonged downwards into the pterygoid process and base of the greater wings of the bone. Occasionally they extend into the basilar process of the occipital bone, nearly as far as the foramen magnum. Thus

we see that a dehiscence or a necrosis of the posterior or upper wall of the sphenoidal cavity can easily give rise to a pulsation within the sinus. Naturally, any engorgement of the large blood vessels would bring about this exaggeration of the pulsation, and this is easily done by compressing the internal jugulars.

In our experience the prognosis of this form of sphenoiditis is much graver, especially as to the length of time, than an ordinary suppurative case. The etiology is based upon a luetic infection and leads us to believe that there is an actual necrosing osteitis, which causes a greater destruction than the ordinary sphenoiditis in which the pathologic lesion is limited to the lining mucous membrane or a superficial osteitis. The treatment, besides the ordinary local routine one, is directed to the underlying cause, viz., lues, and a long intensified anti-luetic treatment must be undertaken. In these cases one must be cautious in probing and curetting, as it would be quite easy to lacerate the cavernous sinus or even the carotid, and the ensuing hemorrhage would be severe and probably fatal.

The points which I desire to emphasize in this condition of pulsating sphenoiditis are: (1) there is a necrosing osteitis which destroys a portion of the bony wall of the solid cavity or there may be the congenital dehiscences, thereby permitting the pulsation to be transmitted from the carotids through the cavernous tissue to the sphenoid. (2) The underlying etiologic factor is lues and often this must be carefully searched for, as none of our cases gave a positive history. (3) The duration of the sphenoiditis is unusually long, most of our cases lasting from eighteen to twenty-four months. (4) The treatment is (a) surgical, *i e.*, at least seeing that the opening is sufficiently large to permit drainage and (b) intensive anti-luetic treatment, both by salvarsan or similar products and by mercury and potassium iodid.

XLIII.

CASE OF INTRANASAL EPITHELIOMA.—CURED BY
EXCISION AND RADIUM.—LITERATURE.

DUNBAR ROY, M. D.,

ATLANTA, GA.

Mrs. S. B. R. (white), age 42 of Toccoa, Ga. Patient consulted the writer on account of some soreness and stopping of the left nasal cavity which had been present for several months.

History. Patient was of an unusually strong and healthy looking physique. Weight 160 pounds. Had never had any severe illness nor chronic complaints which necessitated the consultation of a physician. No history of any malignant disease in her family. Her only complaint was susceptibility to colds in the head.

Present History. For the last three months has had some irritation and some stopping of the left nasal cavity. This was accompanied by scabby condition and an occasional bloody discharge. She had been able to see a small growth just within the external opening on the outer side which was evidently increasing in size.

Examination. No external swelling or congestion. No enlargement of the cervical or submaxillary glands. On inspection just within the left nasal cavity could be seen a small growth at the anterior end of the inferior turbinate close to the mucocutaneous margin. It was dry and about the size of a bean, slightly scabby, sessile in form with a slight tendency to bleed if touched. The patient gave no history of nose bleed. To all appearances the growth gave every indication of being a fibrous papilloma. Under cocaine anesthesia the growth was very easily removed with the cold wire snare and the raw surface cauterized with the electrocautery. There was very little hemorrhage.

The growth was submitted to Dr. John Funke, pathologist, who gave the following report:

"Specimen consists of a reniform mass 1.2 by 0.6 by 0.4 cm. which is reddish grey in color and rather firm.

Microscopic Examination. The sections are surrounded by a stratified layer of squamous epithelium which at one point is clearly destroyed by a very small ulcerated area. Extending from this area for a short distance the superficial portion of the epithelial stratum is undermined. The structures underlying the ulcerated and undermined area are infiltrated with cells which for the most part are arranged in plugs, but some are in long strings. These cells are polyhedral in shape, are about the size of the cells occupying the lowermost portion of the epithelial stratum. They stain well, especially the nucleus. The protoplasm is granular and rather scanty.

The stroma is abundant, stains rather feebly and contains a few blood vessels.

Diagnosis. "Basil cell epithelioma."

Subsequent History. The patient returned in one week's time, showing no signs of reaction and nothing more upon the surface than would be expected from the removal of a benign growth. A sedative ointment had been given to be used in the nasal cavity.

Nov. 16th, 1919. Three weeks later the patient was again seen. There was considerable irritation inside the nose, accompanied by scabbing and bleeding. The patient said she felt very uncomfortable. She was then referred to Dr. O. D. Hall for radium treatment. I saw the patient at intervals during the radium treatment, but only for observation. The radium was used as follows, being placed just inside the nasal cavity and properly screened.

Nov. 15th, 1919. 50 milligrams. Time 2 hours.

Dec. 15th, 1919. Same amount. Time 4½ hours.

Feb. 11th, 1920. Same amount. Time 2½ hours, making a total of 450 milligram hours.

Jan. 15th. Examination shows a complete disappearance of the growth, smooth surface, and only slightly scabby condition.

Oct. 22nd, 1920. Nasal cavity looks normal and patient told to report at the slightest indication of discomfort in the nose.

A letter from the patient May 15th, now 19 months since operation indicates there is no further trouble.

Contrary to the opinion of several observers, my own experience leads me to conclude that radium is much more effective in epitheliomata than in other forms of malignant growths.

In 1919, before the American Ophthalmological Society, I reported two cases of epithelioma of the eyeball, where exenteration of the orbit followed by the use of radium produced a complete cure up to the present, six years in one and eleven years in the other.

In 1916, the writer reported a case of epithelioma of the pharyngeal wall treated by complete excision with the electric cautery, and which has remained cured up to the present date. Radium was not used, but in epitheliomata accessible for complete excision, especially by electrocautery, results will nearly always be favorable. This has been frequently demonstrated in the removal of skin epitheliomas in the region of the face or from skin surfaces.

The cure of epitheliomata is entirely a different proposition, however, when they are located in a vascular region like the ethmoid or have their origin in a closed cavity like the antrum maxillary. Thorough eradication is practically impossible, but it is in just such cases that radium does its best work.

The splendid results shown in Boston last year by Drs. Barnes and Greene in the combined use of surgery and radium in malignant growths of the head certainly leads us to be far more optimistic in our views than has heretofore been the case.

I take the liberty of presenting a bibliography of the literature bearing on the treatment of nasal epitheliomata, especially in regard to the results obtained by the use of radium. No doubt this is far from being complete, but if other observers will add to this series, we may begin to have more exact statistics.

RADIUM IN THE TREATMENT OF EPITHELIOMA OF THE NASAL CAVITIES.

CASE REPORTS.

Adam² reports a case of endothelioma in which the tumor filled the right half of the nasopharynx, appearing to grow from the eustachian orifice. Two radium applications were

made on November 29, 1915, and January 12, 1916; 50 mg. of radium screened by 1 mgm. of gold was applied for twenty-three hours at the first treatment, and for eleven hours at the second. At the time of the report, August, 1916, the parts seemed normal. Sufficient time has not elapsed to establish a permanent cure, but the result is certainly better than could have been obtained by surgical interference. (Sonnenschein refers to this case as epithelioma.)

Botey⁵ treated two cases of endonasal epithelioma with radium with poor results. In both the growth progressed and the patients died.

Delavan⁶ in his report on radium in the treatment of the growths of the upper air passages, at the Memorial Hospital, includes three tumors of the "nasal mucosa," treated by radium. Two of these had advanced recurrent lesions. (The nature of these tumors is not indicated.) In the third case, a recurrent epidermoid carcinoma of the posterior portion of the nasal septum, occluding both nasal passages, an excellent result was obtained by removing the growths with a snare and treating their bases with radium. There was no recurrence in three months.

"The difficulties of making accurate applications of radium to the nose are very great, unless the lesion is an early one and situated low down." These cases are also reported by Janeway in his book.¹¹

Hill⁹ reports one case of epithelioma originating in the left antrum, extending into the nasal cavity, the ethmoid cells and nasopharynx, treated by radium; 100 mgm. of radiobromide was inserted through a breaking down area over the hard palate into the antrum; 50 mg. into the same cavity by the inferior nasal route; a small tube of 20 mg. in the ethmoid region; a fourth tube of 50 mg. in the nasopharynx. A 48 hour exposure was made, as the growth was fungating. The growth cleared up within a few days, but apparently had invaded the cranial cavity, as the patient died "shortly afterwards" from intracranial pressure.

In general, Hill says that radium is worth trying in any malignant growth of the nose and throat "which is considered hopelessly outside the range of radical excision by the knife, provided always that an adequate amount is available,

and that the primary growth is accessible and not too far advanced and extensive, that the secondary adjacent growths and more remote metastases are not a contraindication, and provided also that the general health of the patient is fairly good." If an extensive growth is treated and reacts well, a massive dose of toxins may cause not only general malaise and fever, but "a very definite toxemia."

Generally speaking, round cell sarcomas and most endotheliomas react rapidly and consistently well to radium; spindle celled sarcomas and fibrosarcomas react fairly; squamous epitheliomas and carcinomas "are far more uncertain in the way they react to radium. It may be asserted, however, that some epitheliomas in the nose, throat and gullet do react beneficially to radium, in striking contrast to those of the tongue and of the vulva."

In the case reported the author calls attention to the fact that the tumor—through an epithelioma—reacted immediately "after the manner of a round celled sarcoma." There is usually, he says, a longer latent period in carcinoma.

Kelly¹² reports one case of epithelioma of the nasopharynx, the tumor being attached to the roof and resting on the palate, hiding the entire right posterior nares and all but the outer segment of the left posterior nares. Nasal fossæ normal. It caused nasal obstruction and a severe hemorrhage. On January 27, 1915, 50 mg. of radium was screened with 2 mm. of silver and covered with 2 mm. of rubber was applied for twenty-four hours. This caused ulceration of the palate and fauces for a week. On March 10th, the tumor had shrunk so that the nose was free, but a small rounded mass was still present on the roof of the nasopharynx. Radium was again applied in the same dosage as before. On May 14th and June 2d there was no sign of the growth, but the site of origin was covered by an adherent crust of mucus. Underneath was an apparently healthy surface. A third radium treatment was given on June 2d. Last examination on February 22, 1916. Still crusting behind the right choanal arch, but the underlying surface was healthy, and there was no sign of recurrence.

Kofler¹³ reports on the treatment by radium of three lymphosarcoma and eleven carcinoma of the nose, mouth and throat.

The results were better in the carcinoma than in the sarcoma. One of these was a basal cell carcinoma filling the right side of the nose, originating from the region of the infundibulum. Operation of Langenbeck, followed by application of radium. Patient in good health and free from recurrence at last report. (Operation in October, 1912; report published early part of 1913, exact date not given.)

New¹⁰ reports results from the use of radium in 211 neoplasms of the nose, throat and mouth at the Mayo Clinic.

In cases suitable for surgical treatment, radium alone is not used, he says.

Of the 211 tumors, 9 were intranasal epitheliomas and 5 epithelioma of the nasopharynx. In regard to the results, New says, "it is too soon to report end results in this group."

Of the results in nasal epithelioma he says that: "Operative measures in the treatment of epithelioma of the nose are usually of little value. Radium frequently clears up the ulceration and discharge and scars down the growth, giving the patient much relief, and sometimes accomplishing more than this." No further detail in regard to results is given.

The author's general conclusion is: "The immediate results of the treatment of neoplasms of the nose, throat and mouth with radium are, as a whole, very encouraging. Many patients previously operated on with a recurrence following are now treated with radium and the neoplasm disappears, giving months or years of relief, with no surgical mortality. The patients are made much more comfortable than they would be with an operation. The number of patients that will be permanently cured of a true malignancy with radium is probably very small relatively, but the number of inoperable cases that are markedly relieved and receive months or years of comfort is quite large. We do not, however, recommend the treatment by radium of any neoplasm that is surgical. In such cases the patient should have the benefit of both surgery and radium. The use of radium has entirely changed the prognosis in neoplasms of the nose, throat and mouth."

Schmeigelow²⁰ reports twelve cases of malignant tumors of the nose, pharynx and oral cavity treated by radium in 1918 and 1919. Three patients died; one (epithelioma of the right tonsil) from metastasis in the liver; one (cancer of the left

tonsil) from recurrence in the pharynx with ulceration and hemorrhage; one (nasopharyngeal sarcoma) from septic abscess without recurrence or metastasis of the tumor. In one case (epithelioma of the soft palate and left tonsil), the tumor disappeared, but the patient suffered from a radium burn, probably due to a faulty radium tube. In another case (cancer of the tonsils) the tumor did not recur, but the glands were involved and continued painful in spite of both radium and Roentgen treatment.

In the other patients of this series, results were excellent, without recurrence in a year or over. One of these cases was an epithelioma of the nasopharynx in a woman 70 years old. The tumor was located on the posterior wall of the nasopharynx. Three radium tubes (30 mg.) of radium were applied through the nose for 24 hours on June 26, 1919; this was followed by immediate improvement, but two subsequent treatments were given as a preventive on July 31st and October 11th, although the tumor had entirely disappeared, and the tissue appeared entirely normal. Clinically the cure was complete at the time of the report (June, 1920).

Schmeigelow says that Lederman and Kuznitzky¹⁵ report one case of advanced squamous celled epithelioma of the nasopharynx which improved under Roentgen treatment, but was entirely cured by mesothorium and radium. Their original report is not available.

II.—CASES OPERATED.

(Including only a few cases operated. See also notes with reference for results with operation.)

Beck⁸ includes in his report on malignant disease of the upper respiratory tract, 7 cases of intranasal carcinoma, including the accessory sinuses; 3 cases operated; 5 followed up to recent date. All died.

Dougherty⁷ reports two cases of epithelioma of the frontal sinus, both operated. One patient died several weeks after the operation from purulent meningitis; the other died two months after operation from extension and ulceration of the growth.

Ferreri⁹ states that epithelioma of the nasal fossæ is undoubtedly rare. His table of cases shows 1 epithelioma of the antrum of Highmore, cured by operation; 1 case of rhino-

pharyngeal epithelioma inoperable, death; 5 cases of epithelioma of the nasal fossæ and diffuse epithelioma of the nose, of which one was cured by operation, the others were inoperable; 1 epithelioma of the left maxillary sinus, not operated. One epithelioma of the roof of the mouth was treated by radium; the patient died. This is the only case of epithelioma included in the report in which radium was used.

Thomson²³ reports two cases operated, using Moure's operation. Case 1. Endothelioma of the ethmoid and antrum: Moure's operation; no recurrence in 5½ years. Case 2. Epithelioma of the left maxillary antrum; Moure's operation; no recurrence after 3½ years.

III.—GENERAL CONCLUSIONS IN REGARD TO THE VALUE OF
RADIUM IN THE TREATMENT OF EPITHELIOMA.

Boggs⁴ makes no mention of epithelioma of the nasal cavities specifically, but says in regard to radium treatment of epithelioma in general:

"Primarily epithelioma is not a surgical disease, because, in order to remove all the cancerous cells, it is nearly always necessary to remove too much healthy tissue. The permanency of the end-results, in the past few years in many thousands of cases, has shown that radiation far surpasses any other method.

"Radium is the best form of radiation locally on the lesion and in regions where glandular metastases are likely to take place. Radium used over glandular centers or junctions with complete roentgen treatment over the tributaries, is far superior to the most complete and often unnecessary dissection."

"Each year," he says, "there is a smaller percentage of surgeons removing epitheliomas. I do not mean to say that surgery is never indicated, but I believe that it is seldom, if ever, indicated in primary cases."

Janeway¹⁰ in his 1918 article says that at the Memorial Hospital they "have been encouraged to treat a rather large number of operable cancers of the mucous membranes" with radium. "The remarkable improvement in some of the cases treated palliatively has not alone stimulated this attempt, but more especially the favorable result obtained on many early cancers in patients refusing operation, or in whom operation was contraindicated for other reasons. Two facts have been

demonstrated by this experience; first, within the time limits in which we have been working, single applications were often sufficient to cause apparent complete retrogressions; and second, in the larger lesions, where this favorable result was not obtained, the lesion has become more of an operable one than it was before treatment."

The cases reported by Janeway in this article do not include any malignant growth of the nasal cavities. See report under Delavan's name in section on case reports.

Lannois, Saignon and Moutet,¹⁴ in their report on radium therapy in tumors in otorhinolaryngology, report 13 cases treated by radium. These include six tumors of the nose and sinuses, and four tumors of the nasopharynx, but all of these were sarcoma, none epithelioma.

In general, they say that nonepithelial tumors are much improved, often completely cured by radium, but that results are not so good in epithelioma, especially ectodermic epitheliomas containing epithelial pearls (globe corné) are very slightly influenced by radium.

Pancoast¹⁵ reports several cases of sarcoma and carcinoma of the tonsil and one case of sarcoma of the left turbinates and antrum. No case of epithelioma of the nose or nasopharynx.

His general conclusions are:

"In the treatment of inoperable malignant growth, originating in cavities such as the mouth, throat and ear, radium therapy is an extremely valuable adjunct, for the reason that it can usually be applied directly to the growth, which is more or less inaccessible to direct roentgen ray exposure. This alone is not sufficient, and the growth should also be attacked from every possible direction by cross firing, either by radium or roentgen rays or both. Any near by area in which metastasis is likely to occur should also be exposed.

"Sarcomatous growths, especially in the tonsillar region, are more amenable to treatment than carcinomas.

"It would be best to continue treatment for some time after the apparent complete disappearance of the growth."

Sonnenschein²² in his paper on radium in the treatment of malignant tumors of the nose and throat says little definite in regard to epithelioma of the nasal cavities as distinguished

from other malignant tumors. The specific cases mentioned by him are reviewed elsewhere in this report under the authors' names.

In his table he includes 41 malignant tumors of the nose and sinuses in which radium was "the main form of treatment employed"; of these 13 were apparently cured, 2 were free from recurrence for one year or more, 14 were improved, 12 unimproved. Of 12 cases of malignant tumors of the nasopharynx treated by radium all were apparently cured. This table does not differentiate between carcinomas or sarcomas. Some writers, Sonnenschein says, "merely speak of 'malignant disease' of certain tissues or structures so that it is impossible to differentiate in the table."

From the study of the subject presented in this article he comes to the conclusion that:

"The future of radium therapy seems very bright, particularly in reference to applications in tumors of the nose and throat; but great caution is advisable in statements regarding actual cures. It is important to watch for recurrences during a period of from two to five years.

"Radium is probably of great value before, and certainly after operations. It is very efficient in relieving pain, hemorrhage, discharge, etc., in many inoperable cases.

"Sarcomas are especially responsive to radiation; the carcinomas yield much less readily, and the squamous type of epithelioma is scarcely amenable to radium at all.

"Radium has many advantages as compared with roentgen rays, especially for application in the nose and throat.

"The diagnosis of the malignant cases should be made by a competent laryngologist, and the radium applied either by him or in cooperation with a radiologist. Only in this way will correct statistics and reliable results be obtained, with greatest benefit to the patient and the safest guide to the profession."

Wickham and DeGrais²⁴ say that "the value of radium in malignant tumor of the mucous membrane is incontestable, but varies according to the region and the nature of the tumor—sarcoma being by far the most amenable to treatment."

Their cases reported do not include any malignant tumors of nasal cavities.

Barnes reports a series of malignant tumors of the nasal accessory sinus treated by operation and radium. For the operation the Moure incision is made in the cheek, and "every particle of tumor tissue, all necrotic or soft bone" removed. Wherever possible, it is desirable to remove a small margin of normal tissue. A triangular flap of integument, "having its base in the upper incision and its apex at the lower limits of the antrum," is removed from the cheek, leaving a permanent opening into the operative cavity, so that any tendency to recurrence may be observed. The deformity following this is not great. The cavity is lightly packed with gauze, in the center of which a radium emanation tube "of appropriate strength" is placed. The tube remains in place about two weeks, being reinserted at each dressing. As the tube loses one-sixth of its radiating strength every 24 hours, it is practically inert at the end of convalescence. Three or four later radium treatments are given at weekly intervals as a preventive measure. Marked reaction of the tissues should be avoided in these treatments.

In the series reported by the author there were six carcinomas, one small round celled sarcoma and one fibrosarcoma. With the exception of the last named, all were of long standing and involved both the ethmoid and the sphenoid. Three (all carcinomas) were operations for recurrences, and one (sarcoma) had had an enucleation of the eye one year before, further operation being abandoned on account of the extent of the growth. Neither sarcoma shows any sign of recurrence (14 and 26 months after operation). Of the carcinomas, three patients have died, one has extensive recurrences, two are well with no sign of recurrence 25 and 17 months after operation respectively. One of the deaths was postoperative, due to septic meningitis. The carcinoma in this case involved all the sinuses except the frontal.

The author believes that in these massive tumors of the sinuses "radium without operation is useless." However, "thorough operation combined with immediate radiation through a wide opening in the face which for purposes of observation is allowed to remain permanently, will give, I believe, better results than we have been accustomed to consider possible."

Guichard reports two cases of epithelioma of the nasal fossa that invaded the sinuses, the orbit and, in one case, the cranial cavity. No treatment is reported in one case. The other case was operated and given several X-ray treatments. The treatment was successful and the patient remained in good health. (Operation in August, 1919; report published March, 1920.)

In a later article (October 10, 1920) Lannois and Saignon review their work on radium treatment of tumors of the ear, throat and nose, but report no new cases. In their work they employ Dominci radium tubes; they use doses of 25 to 160 mg., left in place for 6 to 24 hours, occasionally for 36 hours, exceptionally for 48 hours.

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XLIV.

CANCER OF THE LARYNX.

By N. B. CARSON, M. D.,

ST. LOUIS.

In treating the subject of cancer of the larynx it seems like ancient history to go back to 1887, when I did my first laryngectomy. Since that time I have had four other cases, with three operative deaths. This is a very high mortality and would seem to make the operation of laryngectomy unjustifiable were it not for the fact that others have been more successful and had the mortality not steadily decreased from 40 odd per cent at that time to about 10 per cent at present. This change has resulted from improved technic in operative methods, but principally from the introduction of intratracheal and especially local anesthesia.

This mortality was due in part, if not entirely, to the fact that the cases were not selected, as I do not believe the comfort of the patient should be sacrificed for the benefit of statistics. I have seen many apparently hopeless cases of cancer relieved of their sufferings—very materially relieved—and their lives made decidedly more endurable and sometimes saved by operation. In a case that I call to mind, a patient had an apparently hopeless cancer of the breast and I did what I intended to be a palliative operation, making it as complete as possible; it was so complete that the patient is still alive, with no signs of return of the disease, after more than thirty years.

Of the malignant diseases affecting the larynx we have both sarcoma, which is very rare, and carcinoma, but I shall consider carcinoma only, as I have never seen a case of sarcoma.

Jacobson (*Operations of Surgery*, 5th Edition, 1908, Vol. I, page 657), referring to the subject of extreme disease of the larynx, says: "The question as to how far operations in these cases are justifiable arises. Interference here is one of those instances in which the surgeon may have a difficulty in deciding where to stop owing to the extent of the disease. Where the

pharynx, epiglottis and surrounding soft parts have been extensively extirpated the patient usually gains a prolongation of life, rarely a cure, at the cost, to put the matter moderately, of great discomfort."

Jacobson then quotes Cohen, who says "it is most important to distinguish between recovery and mere survival after operation in these cases." Continuing, Jacobson refers to Prof. Gluck's article (*British Med. Jour.*, Oct. 21, 1903, page 1122), doing so only to condemn his views. He says: "To enable my readers to form an opinion for themselves in this matter, I will refer them to the illustrations in Prof. Gluck's article above referred to, wherein the results demonstrate what especial experience may achieve with especial operative skill, but this is only half the picture. Such figures as those, showing the steps in the technic by which such results may be attained, show also inevitable mutilations by which the patient's future must be rendered a sad one."

Just here I would ask, can the patient's future be made more sad by operation than it is before operation, in advanced cases?

Quoting Prof. Gluck's words in the article referred to in the *British Medical Journal*, where he says "first save and prolong the life of your patient, and do not trouble yourself too much about the post-operative state; the restitution of function will be a secondary care, the imminent danger once dissipated." Jacobson says these remarks are justified, as far as they go, but they do not go far enough, and he claims, without the least exaggeration, the fact remains that, of all the mutilations inflicted by surgery, that for extrinsic malignant disease of the larynx is the most terrible." Jacobson and others who oppose operations for extrinsic cancer of the larynx and, for that matter, cancer in other parts of the body, seem to forget that the parts are already destroyed beyond redemption and that the surgeon is not causing a mutilation but that by removing the already destroyed parts he is doing the patient a great kindness in taking away the source of the foul odor and discharges which are the cause of this toxemia which results, and at the same time this removal sometimes ends in a cure.

Further on, in the same connection, Jacobson acknowledges

* that if the patient survives he will be free from pain, especially pain in the ears, and much of his cough from toxemia, and he will put on flesh. How far he can follow any occupation must depend upon the nature of this, and how far it requires the ordinary voice, which of course the patient has lost.

Professor Chiari of Vienna, in an address on cancer delivered before the Laryngological, Rhinological and Otolological Societies in 1909, states that "it is remarkable how long, comparatively, these patients may remain in this stage without being delivered from their terrible suffering by an inflammation of the lung or a toxic condition of the blood. They generally succumb to the ever increasing weakness from disturbed nutrition and frequently recurring hemorrhages. On this account any effort to cure cancer of the larynx is a real blessing to humanity, and a surgeon is likewise obliged to undertake serious operations if there is merely a prospect for radical cure." To this statement I will add that if there is a chance to relieve the sufferer for even a short time he should have the benefit of that chance, regardless of statistics.

There are two methods adopted for the relief of cancer of the larynx. One is palliative and employs so-called cancer cures, which include injections into the blood, into the muscles and under the skin, and also X-ray, radium, etc. If cures come from these methods, I have never seen them, but I have seen bad results follow their employment. I have in mind one particular case of an intrinsic cancer, a most favorable case for removal, where the patient was persuaded to submit to injections into the blood, and died in a comparatively short time and in much suffering.

The other method—surgery—has up to the present time been the only successful method of cure, and I must here join the large army of surgeons who treat cancer and who believe that in order to be successful the removal must be early and thorough.

Of the four surgical methods employed for the removal of cancer the internal method would not be considered if it were not that some operators claim that with the aid of the suspension apparatus growths in the larynx can be diagnosed early, their limits clearly defined and in some cases satisfactorily removed. This may be true in the hands of a

few experts provided with the suspension apparatus, but the procedure itself must necessarily be in most cases not only unsatisfactory but dangerous.

While I have seen cases of tumors, supposed to be malignant, removed from the inside that have recovered and remained well, I cannot help believing that the procedure is unjustifiable for the reason that we cannot be sure that the removal is complete, and if not complete new avenues for infection would be open. In this connection I wish to enter my very decided protest against the custom of taking pieces for examination, unless the patient's full consent has previously been obtained to proceed immediately with the operation if it should be deemed necessary. I believe there is danger of a spread of the disease from the opening up of avenues by incomplete removal. I fully agree with Dr. John Mackenzie when he says "the removal of a piece for microscopic examination too often means the beginning of the end." Chiari claims this statement to be incorrect, as he says many operators, including himself, have never seen such a result, but he goes on to say, almost in the same breath, "that he does not wish to deny that any incomplete removal of a carcinoma may increase its growth." He then, as proof of the last part of his assertion, cites a case of Knight's in which a growth on the vocal band, held to be a singer's node, was removed by the cold wire snare and recognized to be cancer, whereupon a rapid growth of the carcinoma resulted, and he says "there, as I have long claimed, the external operation is not to be postponed longer than a few days, or at most two weeks after the removal of the piece for examination if the carcinoma has been determined histologically. In this way the intralaryngeal operation can do no harm."

I cannot agree that the incomplete removal of the growth, under any circumstances, is free from danger of a spreading of the disease, even for a few days, and I think, as I have said above, that this incomplete removal should never be undertaken unless there is a perfect understanding with the patient beforehand. In this opinion, I think, I will be supported by most surgeons who have much experience in the treatment of cancer.

Quoting from Jacobson again, who says Newman of Glasgow sounded the following note of warning: "Intralaryngeal

excision for microscopic purposes exposes the patient to very serious danger by increasing the rapidity of secondary new formations. The incision of a cancerous growth, or its partial removal, has justly been regarded as a most dangerous procedure, probably because the absorption of the infected material takes place rapidly from a wounded surface. While conscious of the propriety of removing portions of a laryngeal neoplasm for diagnostic purposes, I desire to express my strong conviction that it should not be resorted to unless the patient is willing to have a radical operation performed immediately after the diagnosis is completed."

In proof of the statement that a section of cancerous growth taken for any purpose is dangerous unless followed immediately by a radical operation, I will cite two cases: First, one by Cobb of Boston (*Annals of Surgery*, Feb., 1905), who reports a case where an interscapular thoracic amputation was to be done and where the patient insisted that a diagnostic incision be made. This step showed that the deltoid was infiltrated. Very sharp reaction followed and eight days later, when the major operation was performed, numerous thrombi were found in the subscapular vein.

The second case was that of a young doctor who came to me, referred by the surgeon who had operated on him three weeks before but had not succeeded in removing the growth entirely, because the periosteum and bone were involved. When I saw him the infiltration had already reached the shoulder and, as in Cobb's case, the disease had spread through the incised veins. Three weeks after I saw the patient I did an interscapular thoracic amputation. Microscopic examination proved the tumor to be a mixed celled sarcoma, thus confirming the diagnosis made of the section at the time of the first operation. This patient is still alive and practicing his profession after the lapse of fourteen years.

Thyrotomy as a means of removal of cancer of the larynx is very highly extolled by Butlin, Semon and others, who claim most brilliant results in small freely movable growths involving the front part of the larynx and in persons over forty-five years of age.

E. J. Moure of Bordeaux (*Revue de laryngol., d'otologie et de rhinol.*, Jan. 15, 1920) claims that "in persons under

forty-five cancer is very malignant and is more likely to return than in old persons and therefore laryngectomy should always be done in these cases."

In confirmation of this assertion I can cite a case of a friend of mine who had a small growth removed from his larynx before he was forty-five years old only to have it return in a comparatively short time. He then had it removed by hemilaryngectomy, but again it returned and further operation was denied him and he was condemned to X-ray, much suffering and death, which fortunately soon followed.

Thyrotomy has one great advantage and that is that it exposes the growth and enables the operator to get a correct idea of its limits, something that is impossible when depending upon the laryngoscope. This proved to be true in all the cases that I have operated upon, as the disease was found to be far more extensive in some of them than the laryngoscopic picture showed it to be.

A careful study of the literature on this operation convinces me that it should be limited to a comparatively few favorable cases, and that when so limited the results are more than favorable, while on the other hand a complete extirpation, if it had been done on a number of cases unfavorable for this operation, would have saved a number of lives.

The operation for removal of half of the larynx for cancer should not be considered justifiable as when the disease has gone beyond the reach of thyrotomy it, without doubt, has advanced beyond the reach of hemilaryngectomy. It is a much more dangerous operation and one more difficult to perform than laryngectomy and should never even be considered after a return of the disease, following any other attempt to remove the cancer, as a complete laryngectomy—very complete—is the only procedure to be undertaken in these cases.

From my personal experience with cancer of the larynx, and from the cases of others that I have been privileged to see, I feel safe in affirming that laryngectomy, as done at the present time, is the operation of choice in all but a comparatively few cases. With the present technic it is a fairly safe procedure, and when done early there will be fewer returns than by any other method. In my second case, during the consultation, the question arose whether on account of the high

mortality and on account of the mutilation that would necessarily result, and which was likely to destroy his usefulness, it would not be better to postpone the operation until such a time as he would be compelled to give up his work on account of the advance of the disease, especially as he was then earning good wages as a bricklayer. To that I would not consent and, fortunately, the patient agreed with me that if he were operated on at once his chances of recovery would be decidedly better and he would in the meantime be saved much suffering and would probably be able to earn his "good wages" much longer than if he were to wait for a "last resort" operation.

The wisdom of this conclusion is evidenced by the fact that he recovered and was back at his work in less than three months and that now, after seventeen years, he is still well and is earning the wages of a bricklayer and, moreover, he is able without artificial means to make himself understood not only by his fellow workmen but by almost anyone he may come in contact with.

My first operation for laryngectomy was done on a woman, the only woman that I have ever seen with cancer of the larynx. In this case, in order to confirm the diagnosis of cancer, we gave her large doses of iodid of potash, which resulted in edema of the larynx, which necessitated tracheotomy. The opening in the trachea had to be made very low and the tracheal tube used proved to be too short so that it was with much difficulty that it was kept in position during the night. In spite of all our efforts it came out the next day, but in the meantime it had accomplished its purpose, the edema having subsided sufficiently to allow the patient to breathe with comparative comfort. No effort was made to return the tube, and when the laryngectomy was done the tracheal wound had entirely closed.

It had been my intention to remove the larynx without the aid of a preliminary tracheotomy, a step in the operation which was thought by most operators at that time to be the best method, but this forced tracheotomy did not cause me to make a change in my technic. The larynx was removed after a complete separation of the soft parts, including large cervical glands, through a "T" incision, and the trachea was then divided, cocaineized and lifted out of the way and the anesthetic

tube inserted. The larynx was then removed from below upwards with very little loss of blood and scarcely any shock. After the larynx had been completely removed I noticed that the mucous membranes from the larynx and pharynx fell together in such a way as to shut off the pharynx from the field of operation. Recognizing the advantage of this condition, I introduced sufficient sutures to hold the parts together. The patient made a rapid recovery and a year later died from a heat stroke without any evidence of a return of the disease. I saw her several months after the operation and she expressed herself as being comfortable and as well satisfied with her condition as one could be without a larynx. She was able to make those about her understand her wants without much difficulty.

My third case was also one of special interest. In the first place because it was associated with a latent tuberculosis of the left lung. Although tubercule bacilli were present in the sputum, it was not thought of sufficient seriousness to contraindicate an operation to relieve him of his suffering. In the second place, on account of the fact that two pieces removed from the larynx at different times by the same operator (Dr. H. Loeb) brought two different opinions from two pathologists who examined them. Here we have an example of how little reliance is to be placed in examination of sections taken by the intralaryngeal method. If we had not been satisfied from the appearance of the growth presented by the laryngoscope we would have allowed the patient's suffering to increase with the disease without an effort to relieve it. This patient died on the eighth day after the operation. Cause unknown.

The above cases were reported in the *Interstate Medical Journal*, July, 1904.

The fourth case was a male, fifty-two years of age, and was one of extrinsic cancer involving the larynx, the epiglottis, part of the pharynx and part of the esophagus. When he entered the hospital he was suffering intensely and was literally starving to death. In order to nourish him and diminish the pain a gastrostomy was done, after which his condition was very materially improved and his suffering relieved somewhat.

Gastrostomy is now often done as a step in laryngectomy and it is claimed that it lessens the danger of bronchopneu-

monia by diverting the food from the mucous membrane closing the pharynx, as this membrane is often infected by the food passing over it and by the pressure of the permanent feeding tube. This operation also prevents the mucous membrane closing the pharynx from being torn by the introduction of the tube for the purpose of feeding the patient.

When this patient was operated upon the parts involved proved to be more extensive than they had been thought to be before the operation. He lived several days and died of bronchopneumonia.

The fifth case was also done to relieve the patient of his sufferings. He was operated on July 23rd and died August 1st from bronchopneumonia. I regret that I did not do a gastrostomy in this case, as the sutures in the mucous membrane closing the pharynx gave way, allowing the field of operation to become infected, this infection extending to the lungs caused the bronchopneumonia which caused his death.

The last two cases have not been reported before and are not as complete as I would like to make them, as the records were either lost or destroyed while changes were being made in the hospital.

In conclusion, I would like to make a prediction that the plastic operations which are being done at present to close defects left by the extensive removal of parts destroyed by the disease and for the restoration of the part of the esophagus necessarily taken away, will be further extended and by the use of cartilage grafts, aided by skin flaps and skin grafts, a very good imitation of the larynx will be made which will overcome one of the objections to laryngectomy.

XLV.

ROENTGENOLOGY OF THE MASTOIDS WITH CON-
CLUSIONS BASED ON ONE HUNDRED CASES.*

BY FRANK R. SPENCER, M. D.,

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The difficulties of obtaining accurate radiographic knowledge of the mastoids have been many. However, these have been largely overcome in the past few years by improved positions for both the patient and the tube, so that the work of the roentgenologists have greatly facilitated an accurate diagnosis. In fact, almost every case should be submitted to an X-ray examination of the right and left mastoid prior to operation.

Any study of radiograms of the mastoids is of very little value unless one realizes what should be seen not only in the normal but in the abnormal. Iglauer,¹ Lange,² Birkett,³ Pirie⁴ and others have all been pioneers in this field of otology and have worked with the roentgenologist. It has been their untiring efforts which have made this work of practical value in the diagnosis of mastoiditis, especially of the acute type. More recently a very valuable article has appeared by Bigelow⁵ from which I shall quote freely.

Whiting⁶ has emphasized the importance of looking for the lateral sinus well forward in a long, narrow mastoid process while operating. Conversely it lies far back, as a rule, in a wide process. The pneumatic and diploic types have long been recognized anatomically and surgically, as well as a combination of these two. Theoretically a pneumatic mastoid should be the easiest to examine by X-ray. However, a very thick cortex over all or most of the cells may increase the difficulty of recognizing the individual cell structure, thus making the process look a trifle cloudy, when in reality it is clear. Conversely a thin cortex may give a rather clear radiogram when the cells are at least slightly diseased. It is almost

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needless to state that with extensive necrosis, granulations and pus throughout the mastoid there should be very little difficulty in obtaining a radiogram which will show the extensive destruction. However, it is not a case, with such marked involvement, in which the X-ray is most needed as an aid in diagnosis but a case in which the clinical evidences are less pronounced.

The diploetic type of thick cortex is almost certain to give a slight suggestion of haziness even when the cells are normal. Therefore, the roentgenologist can state only what he finds and his report, like those from the other laboratories, must be weighed and compared with all the rest of the clinical evidence before deciding for or against operation. In spite of this fact, Bigelow⁵ very properly says, "The X-ray is our best consultant," or words to that effect; and, "When in doubt, radiograph; if still in doubt, operate." If his advice is followed there will be fewer exploratory mastoidectomies required, because the X-ray affords one of the best means of determining what changes are taking place in the mastoid process.

If the lateral sinus is well forward, where it may be unintentionally opened, the radiogram will usually show this. However, if well covered with dense cortex, necrotic cells, granulations and pus it is almost impossible to detect its bony groove. The X-ray differentiates densities, so that if all is very dense in the mastoid process the details are lost.

Cheattle^{7 8 9 10} has written extensively upon the mastoid anatomically and he has the following to say: "I apply the term 'infantile' to those bones which retain throughout life the characteristics of the outer antral wall and the mastoid mass as seen in infancy. On making a lateral vertical section through the antrum and the mastoid mass in infancy it will be seen that the outer wall of the antrum is composed of two layers; a thin outer layer of compact bone and an inner layer of fine cells. These cells are formed before birth, therefore I call them the 'fetal cells' to distinguish them from any which may form in later life and from which they can be differentiated always by their fineness and inward direction. The mastoid mass is, as a rule, diploetic, but it may be formed of dense bone. If the mass is diploetic, a thin layer of compact

bone, which can be easily demonstrated by scraping away the diploe, separates it from the antral cavity. There are, therefore, two types in infancy: one in which the mastoid mass is diploetic, and one in which the mastoid mass is dense. Each type may persist all through life but, of course, on an exaggerated scale."

Type 1.—"The diploetic type in the adult. In this type the thin outer compact layer of the antral wall has increased in thickness from the periosteal side and is of extreme density; the inner layer of 'fetal cells' is still seen; the mastoid mass is entirely diploetic and the separating layer between the diploe and the cavity of the antrum is much increased in thickness. Whenever the mastoid process is entirely diploetic the outer antral wall is always formed of dense bone. This type is seen in about twenty per cent of all bones, and it can be seen at all ages.

Type 2.—"The dense form in the adult. In this type the dense mastoid mass persists all through life, but the outer antral wall remains the same as in the diploetic type, the outer layer being very much increased in thickness and of extreme density, while the inner layer of 'fetal cells' is still seen. This form is seen in only about one or two per cent of all bones.

"The outer antral wall is often of great thickness as well as density in these infantile types. The greatest depth of antrum from the surface is seen in them and it may measure three-quarters of an inch (19 m. m.). A forward lateral sinus is usual and is found much more frequently and to a much greater extent than in the cellular types. The sinus often comes well forward below the level of the antrum and may reach the posterior meatal wall, or it may even dip in between the cavity of the antrum and the surface. The antrum may be large or small; if large, the posterior wall may be of extreme thinness and translucency, and may have either the cerebellum or lateral sinus, or both, lying against it. In some specimens the posterior antral wall is pushed in by the cerebellum thus narrowing the antral cavity from before backward. As in all types, the antrum may be highly placed, or the middle fossa may dip down either between the antral cavity and the surface or external to the superior semicircular canal, causing a low, flat antrum."

If the otologist will bear in mind Cheatle's classification while studying the radiogram and while operating there will be less opportunity for errors in interpretation."

Iglauer,¹ in 1909, advocated taking the radiogram at an oblique angle in order to avoid the dense bone at the base of the skull, which in the horizontal plane would be superimposed. To quote him exactly, he has the following to say: "The radiograms were taken in an oblique profile, i. e., the rays coming from the target were made to center just below the parietal eminence on one side of the skull and were directed through the cranium in the direction of the temporal bone on the opposite side of the skull. At this angle the best skiagrams were obtained. In this position Dr. Lange found that the axis of the X-ray diaphragm was tilted upward at an angle of 25 degrees from the base of the skull (Reid's line) and that it was inclined backward 20 degrees from the vertical plane passing through both external auditory canals."

While Iglauer's technic is a very desirable one to follow, this position can be varied slightly by different technicians and yet give satisfactory results. The important things to remember are as follows:

1. The dense bones at the base of the skull are not superimposed upon the mastoid.
2. The mastoid rests directly against the film or negative when the exposure is made, thus insuring more accurate detail in the radiogram.

I believe the method described and advocated by Iglauer in 1909, or some modification of this, will probably give the best exposure with the least likelihood of faulty interpretation. However, this does not permit the taking of stereoscopic plates.

I have often noticed a very good picture of the tip cells in stereoscopic radiograms of the accessory sinuses taken antero-posteriorly, especially in certain types of wide skulls. However, this exposes only a very limited portion of the mastoids. This position was utilized by Kuhne¹¹ and Plagemann¹² in 1908 in their efforts to secure a satisfactory exposure. Voss¹³ and Winkler¹⁴ used the transverse position in 1907.

Stereoscopic radiograms of the accessory sinuses, taken laterally, often show the mastoids very clearly. However, I cannot recommend this method in preference to Iglauer's.

Ingersoll¹⁵ has emphasized the differentiation, which a good mastoid radiogram gives, between slight involvement of the cells and areas of necrosis with destruction of bone and also the absence of involvement of the tip cells in a sclerosed mastoid prior to a radical operation. Hence the necessity of not opening the tip. He believes, in acute cases of the pneumatic type, with areas of necrosis showing, we should operate early and bases this opinion on the radiographic findings.

Bigelow⁵ believes a radiogram will, in most instances, help us at least to detect what the Harvard otologists call a "double decked" mastoid, which consists of two strata of cells separated by a bony partition more or less completely dividing the process into two parts. With a well taken radiogram the deeper cells are less apt to be overlooked at the time of operation.

One is usually able to recognize the following: The external auditory meatus, the mastoid antrum, the internal auditory meatus, the lower boundary of the middle cranial fossa, and sometimes the groove for the lateral sinus as well as the boundary of the posterior cranial fossa. If the tip cells are large these can be more easily seen than the smaller and higher cells.

As otologists we are especially anxious to know in what per cent of the cases the roentgenographic findings are corroborated at the time of operation. With this question in mind I examined the X-ray reports of 100 cases of mastoiditis in the Ear, Nose and Throat Clinic at the Base Hospital, Camp Lewis, Washington. Of this number fully 80 per cent confirmed the X-ray findings at the time of operation. In many of the case records either the X-ray or operative findings or both were very briefly or even incompletely written down. All of these indefinite or doubtful cases are included in the 20 per cent. I believe if the notes had been complete for all of the 100 cases that the X-ray findings would have been confirmed by operation in more than 80 per cent.

Are not these figures conclusive evidence of the value of an accurately taken radiogram? Are other lines of laboratory diagnosis apt to yield a higher percentage of aid in making the complete diagnosis? I am not advocating too great dependence upon roentgenographic findings, especially to the exclusion of other methods of diagnosis, but I do believe the

X-rays are a valuable aid and as such I expect to use them in the future more than in the past.

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XLVI.

A REVIEW OF THE MEDICAL ASPECT OF
AVIATION.

BY CHARLES MOORE ROBERTSON, M. D.,

CHICAGO.

During the past few years aviation has passed from the experimental to a stabilized form of science. It is now a business just the same as railroading, motoring or sailing the seas. Before the recent world war very little attention was given aviation from a medical viewpoint. Although some thought had been given to this branch of the science as early as 1911, at the outbreak of the German invasion it became a means of hostility and thus it became an important matter for each nation to develop its aerial resources to the maximum extent. In our own country we did nothing unusual until two years after the opening of hostilities in Europe.

You are probably all conversant with the work done by the author during the latter part of 1917 and the beginning of 1918. In February of 1918 I read a paper before this society giving the results of experiments conducted upon accepted aviation cadets.

It was in March, 1918, that the Medical Research Laboratory was opened at Mineola, and the real experimental work of the Government began. Up to this time work done by other countries was individual, some doing more, while others did less in trying to solve the medical problems pertaining to flying or the flier.

The history of the work done by the Government is published in a book from the Surgeon General's office entitled "Medical Air Service," and in this book very much valuable information relative to flying may be found.

At the suggestion of the Surgeon General's office, Professors Henderson and Schaefer of Harvard and Yale universities were placed in charge of the Research Laboratory

of our Government, and it was their ideas which formulated most of the investigations which were carried on at the Mineola Laboratory.

Several years ago these two gentlemen, together with two eminent physiologists from Cambridge and Oxford, had done some experiments on Pike's Peak in Colorado to determine the effects of low oxygen tension on humans subjected to an altitude of 14,000 feet.

The thought advanced by Henderson and Schaefer was that being on Pike's Peak and at an altitude of 14,000 feet in a vertical dimension at any other place would be the same and if they tested for low oxygen tension on a mountain they would get the same result as would obtain in a flight in an airplane at that altitude at any place over a level country or at the sea level.

I called the attention of the Surgeon General's office to the fact that there was a marked difference in air conditions on mountains and at an altitude attained on level country by rising through the different strata of air such as we would experience over a flat country.

The observers failed to grasp the fact that the atmosphere flows over mountains like a blanket, while ascending through air on level territory an entirely different condition is experienced in passing through successive strata of air.

I cited the fact that fliers could not cross mountains easily from the fact that they could sail a plane up one side of a mountain with ease, while after they had reached the summit, it was impossible to fly on the level on the far side of the mountain.

As a fact, the plane going over a mountain experiences a downward current of air the moment it passes the summit, and this will surely cause the plane to fall from non-support, and the aviator can only save himself from a crash by sailing around the peak till he meets the upward flow of air as it mounts toward the peak from the direction he approached the elevation.

For example, if the flier is sailing from east to west he can easily climb the eastern side of the mountain till he reaches the top, when the down current will be so great he must veer to the north or south around the mountain once more to pick

up the east to west current of air or he will crash on the west side of the mountain.

This phenomenon proves that air flows up and over mountains and therefore results found at the top of mountains will not be the same as conditions at a like altitude straight up in the air over flat territory.

In other words mountains do not, strictly speaking, stick up through the air.

As a result of their theory of low oxygen, the Harvard and Yale professors carried on their work at the Research Laboratory on this one thought, as they felt that this low oxygen was the one and only problem to be met in aviation. It appeared to me that the test instituted was not a test for the fitness of a man to become an aviator, but was rather a test to ascertain how long a man could resist anesthesia, for that is all the test amounted to, as he was fed nitrogen gas in increasing quantity until he collapsed and his endurance was measured by the length of time he could withstand the poison and the result was registered in the low limit of the oxygen of his breathing mixture at the time he collapsed.

I have witnessed strong men who were alert and desirable fail in this test, while others who were thin, sickly looking fellows, could go much further, and yet appeared to me to be inferior subjects for flying.

I do not wish to say the test has not good points, but rather to say it was one-sided, and if the flier were supplied with oxygen tanks, as all should be, they would not have to come in contact with the requirements of any such condition in actual work in a plane.

There is, of course, oxygen loss at great altitudes, and if a man were kept in this medium without a supply of oxygen, he would be under the same condition as is represented in this rebreather test, but it was a common practice before the war ended to supply oxygen through the Dreyer or Clark mask, which fed the gas automatically as the altitude was increased, and which shut off the supply as the altitude was lessened.

This machine did the same thing for the carburetor of the ship also, as it is necessary to have more oxygen for complete combustion of the fuel gas at great altitudes.

Men doing low flying do not require oxygen and where the aviator was doing high flying, the oxygen made him able to do more work without fatigue.

The test for a simulated flight, which was used at Mineola, was a very poor substitute for a flight, as the tank was large and the journey into space was too slow, while the descent was in no way similar to the descent made by fliers in machines. Then, too, they provided oxygen tubes so the man might or might not use oxygen during the test at any time and in any quantity, great or little, as he chose, which amount was not measured at all, so each individual tested obtained a different air mixture. This made the test of no scientific value at all.

I had expressed to the Surgeon General's office that as there was a mask to obtain oxygen at the different levels automatically, the test for oxygen want might be dispensed with, as there were other things which happened in flying which they should consider, such as the change in blood pressure and the loss of carbon dioxide from the body.

This suggestion fell upon deaf ears and, in my opinion, they missed the main medical question pertaining to aviation.

As it appears to me, the aviator should be tested as follows:

He must be found physically sound, which means he must have—

- A. A sound body.
- B. He must have good eyesight without glasses.
- C. He must have a functioning labyrinth.
- D. He must be put through a vacuum test for—
 - 1. Heart and blood pressure changes.
 - 2. Changes due to labyrinth stimulation.
 - 3. Changes in muscle tone for fatigue.
- A. It is not necessary to go into details concerning a sound body.
- B. Good eyesight should mean 20/20 vision for the one eye and not less than 20/30 for the other.
- Imbalance of muscles must not be sufficient to produce diplopia.
- C. The functional labyrinth should not be less than 8 seconds of nystagmus unless the man has been made immune by reason of practice, nor should his nystagmus be more than 35 seconds.

It has been found that the man who has a labyrinth with a low nystagmus finding is less liable to vertigo than one with a more sensitive ear. This was brought out in my original paper, which the Government would not accept at that time. The one will not experience vertigo while the more sensitive ear may produce bewilderment in the aviator and cause him to end in a crash from his confusion.

D. He should be subjected to a vacuum test which simulates an actual flight. That is, he should ascend at the rate of 1000 feet a minute and descend at the rate of 5000 feet in thirty or forty-five seconds, which is a fair average flight. He should be examined before and after the test for—

1. The pressure of his blood, both diastolic and systolic, the character and rate of pulse to determine if the blood stream is elevated or depressed, the pulse accelerated or retarded, or whether they remain unchanged.
2. The labyrinth should be examined after the test to find whether or not the ear is stimulated or depressed or remains the same.
3. The muscle fatigue as measured by the manometer or by measuring the accommodative power to determine how much fatigue is felt.

This will give us a key to the expected deportment of the flier and can be given from time to time to show the condition of the man as to staleness. Many of the rules formulated at Mineola were found to be incorrect, as men were observed after training, and this was particularly true of the labyrinthian tests as expressed by vertigo.

Some of the earlier men at Mineola found that where men were turned repeatedly they developed an immunity to vertigo and when this fact was made known, the work was stopped at once.

In actual practice with troops it was determined that vertigo could be lessened and the observations by Griffith at the University of Illinois showed that the vertigo as expressed by nystagmus could be reduced 50 to 100 per cent in many instances and the immunity lasts for weeks and months. Where the immunity gradually lessened, the subject did not return to the original degree of vertigo on returning after a lapse of months.

In the work by Dr. Mosher and myself, in which men were subjected to the vacuum test, it was shown that vertigo was reduced in nearly all of our cases and in many instances to a degree of 50 per cent with the one test of a few minutes. We noticed the direct relation of nystagmus to blood pressure changes. We found that not only were nystagmus and blood pressure altered, but fatigue as represented by muscle strength occurred in 80 per cent of the cases examined. The material we had to pass upon was the same as that which was used by the Government, and thus our findings should represent the personnel of the aviator as he is.

Time will not permit of my detailing, as might be done, but I wish to ask your consideration of the following points.

1. It is definitely proven that men who have normal nystagmus can by repeated turnings decrease the nystagmus time more than 75 per cent and in some cases to 100 per cent, and this immunity, once attained, will continue for several weeks or months.

That cadets trained in the orientator will obtain immunity quicker and can learn to disregard the labyrinth stimulation in 10 to 20 days with a practice of 10 or 15 minutes daily.

That nystagmus is cut in most cases to one-half by a vacuum flight in a few minutes.

That the man who has a functioning labyrinth with the least amount of nystagmus makes the best aviator and this man can soon reduce his nystagmus to zero.

2. That the pulse and blood pressure are affected in practically all during the vacuum test and that where the blood pressure is elevated to a moderate degree the man is most fit to fly.

That when it is greatly depressed the man is liable to shock and syncope and is the worst possible risk as a flier.

That those whose pulse and pressure remain the same or nearly the same are considered fair risks as fliers.

3. That when muscle fatigue is more than 50 per cent after the vacuum test the man is a bad risk, while the man who remains the same or the muscle force is elevated would be the very best risk as a flier.

It has been noted that many men have fallen to death.

These accidents are due to one of two causes: either from a fault of the machine or a fault in the aviator.

Under the latter head would come men who become unfit as I have outlined above. It was determined in the German Army that many aviators fell and in cases where they were not killed by impact with the earth that many of the planes were covered with blood.

On post mortem examination it was found that the lungs were torn or the aorta was ruptured, which proved the great elevation of the arterial pressure which may occur in rapid descent.

When an aviator ascends he is traveling slowly upward at not over 1000 feet per minute, and is going from a denser medium into a less dense atmosphere, due to less dense air tension.

The surface pressure is removed from the external surface of the body, including the lung tissue.

Therefore, the peripheral pressure is removed from the heart and the pulse beat is quickened, the heart is less filled with blood, which lowers the blood pressure. This has been proven in actual flight by taking readings of the heart in actual flight.

In descent the man is coming down at the rate of a couple of hundred miles an hour, and in the instance of the faster planes he touches the ground at the rate of one hundred miles per hour.

He is traveling from a rare air into a denser medium and the body is subjected to a sudden application of external pressure.

This causes a back pressure upon the heart, which becomes filled fuller with blood, the beat becomes slower and more powerful, which elevates the pressure to a great degree with the attendant rupture of the lung tissue or the aorta or some other vessel in the body, if the blood vessel is unable to take the additional strain placed upon it.

Thus we account for the sudden deaths as found by the German examinations.

We thus may have an apoplexy in the brain or in the labyrinth, producing vertigo or paralysis of some vital area.

This was shown in my former paper in citing the case of aviators who fell to a certain distance in full control of their ship to succumb at a short distance from the earth's surface, and who crashed to death while already unconscious.

Many aviators who have done much high flying show distinct changes in the dimension of the heart, it being hypertrophied and exhibiting pathologic sounds or irregular contractions, as evidenced by premature systolic sounds.

Many men during the war were found to grow stale.

Many of these were neurotic types, while some of them showed distinct yellow streaks, while others were unfitted by too much drinking and social excesses.

Most of our fliers had had less than 300 hours in the air, so that they were not unfitted by actual flying.

I showed in my tests that of the first 50 men examined, that 26 per cent were not able to qualify according to the vacuum test, while in the second series of 50 there were 33 per cent which failed to come up to the standard test

This just about tallies with the percentage of men in actual work who failed as aviators and it showed to me that had they been selected by the vacuum test they might never have been accepted

As aviation has come to be a fixed and routine business with a large number of men, and as it will be but a short while when we will have great transportation companies carrying thousands of persons through the air, it is of the utmost importance that we study the necessary qualifications of the flier and adopt some sort of laws by which we may standardize applicants for positions as aviators or employees in aerial transport service.

It is a great responsibility to be a pilot when we realize that he cannot fail in his efficiency for even a half a second or the ship he is sailing may crash to earth, killing all who are in his charge.

You have read of the new Italian airship, which is equipped to carry one hundred passengers, and the day is here when this mode of travel will become commonplace. It is, therefore, our duty as otologists to do our part in making traveling as safe as possible in this new mode of locomotion.

SOCIETY PROCEEDINGS.

CHICAGO LARYNGOLOGICAL AND OTOLOGICAL SOCIETY.

Meeting of Monday Evening, March 7, 1921.

THE PRESIDENT, DR. ALFRED LEWY, PRESIDING.

Facial Paralysis.

Dr. Joseph C. Beck presented a soldier who had received a bullet wound in the forehead, the bullet passing through the ear and coming out of the scalenous region. The rotation test gave a mild response to the labyrinth. Radical mastoid operation was performed, namely a neuroplastic, employing the facial, spinal accessory and descending hypoglossal nerves. The end of the facial nerve, which was drawn out of the facial canal at the styloforamen, was joined to the severed spinal accessory where it enters the trapezius muscle. Then the descending hypoglossal was severed as low down as possible and joined to the distal (muscular end) of the spinal accessory. The united nerves were surrounded by small collars of fascia obtained in the neck region. This operation was performed in July and the patient now has some action in the lower part of the face.

Dr. Beck pointed out that it was of some interest to note that even if there was complete paralysis of the upper portion, still it was possible to secure considerable action, as was shown by the application of a deep sinusoidal current. The operation was not a difficult one, only made up of details.

The second patient was a little girl, who had an acute mastoiditis in 1920 during an attack of influenza, and had suffered a recurrence this year. The hearing was now good; there was no trouble with the labyrinth. There had developed at the end of the third week, facial paralysis due to disturbance at the tip of the mastoid process. She was operated on (simple mastoidectomy especially at the tip) at 11 o'clock one morning, and at 3 o'clock the same afternoon she had full control of all facial movements, which had remained since the day of the operation. There was a profuse discharge from the ear and great tenderness preceding the operation. The preservation of function of the chorda tympani, demonstrated that the pressure was at the tip of the mastoid. This case was presented on account of the rapid recovery of the complete facial paralysis following operation on the mastoid process.

The third patient had recently had two radical mastoid operations performed by a general surgeon. She was first seen by Dr. Beck one week previously, when suppuration still persisted and there was present complete facial paralysis of the left side. At the time of presentation, in spite of the fact that there had been a

complete facial paralysis, deafness and no reaction to the labyrinth, the patient was beginning to get some action in the lower portion of the face. The paralysis was no longer complete and Dr. Beck would not operate as long as there was a chance of further improvement. Some cases had finally recovered as late as a year after a mastoid operation. This patient was first operated in June, 1919, and again in January, 1920.

The fourth patient was a man who had been in the Balkan military service for five years as a gunner. Both ear drums were ruptured and one labyrinth was markedly involved. An acute facial paralysis had recently come on during an acute otitis in the left, chronically discharging ear. There was no doubt a real connection with the chronic suppurative condition to which attention had been called by Moure (Bordeaux) who had seen many of these cases, and mentioned the dehiscence of the fallopian canal in which acute attacks were liable to set up acute facial paralysis.

Dr. Beck next reported a case of double facial paralysis of a girl six years old, who was now under his care, but too ill to be presented. There was a history of otitis media and the subsequent development of facial diplegia. The face was completely immovable, it being impossible to close the eyes or mouth, for some time, but at present there was a slight movement of some of the muscles of the face. The radiographic examination revealed nothing and the ear was healed, although there was bilateral suppuration in connection with an attack of measles a short time previously. Dr. Beck had seen three such cases, two of them being syphilitic and described as basal meningitis. He illustrated the above case by a number of stereoptographs.

Paraffinoma.

Dr. Beck presented a woman with redness and broadening of the nose, who had been operated ten years previously, at which time paraffin was injected in the region of the inferior turbinate for the relief of atrophic rhinitis. The patient was not seen for several years but recently returned. Her family physician had noticed some swelling about the nose and applied the rays of a solar lamp, and immediately following the use of the light there was increase in the swelling. It was the first case Dr. Beck had seen of a paraffinoma arising from injections within the nose, but he had had three cases of paraffinoma resulting from injections outside of the nose. This patient, in contradistinction, had no pain, the peripheral nerves were not involved, and it was hoped that this complication could be prevented by treatment. A placebo of a mercury plaster was being used and a histologic study of the mass would be made.

Another case demonstrated was a patient from whom paraffinoma had been removed. The removal relieved the pain but the growth was recurring in spite of all treatment. In this case the nose had been injected by a charlatan in this city, who is still performing the same operations. Dr. Beck thought it would be well for the Society to take some action regarding this work and keep the advertising out of the newspapers, if possible. He was convinced that paraffin should not be used in these cases.

Bilateral Otitis Externa and Media.

The last case shown was that of a boy with bilateral otitis media and externa, which did not respond to any treatment, local or general. Both tympanic membranes were perforated and there was present a bilateral suppuration from the middle ear. Diabetes was suspected but repeated examinations of the urine showed no sugar. Two weeks previously the patient developed a large carbuncle on his back, which convinced Dr. Beck that it was a diabetic affair and the patient was referred to Dr. Sutton for a basal metabolism test and blood test and blood sugar was found in excess. He asked the Chairman to give Dr. Sutton, who was present, the privilege of saying a few words about this end of the examination.

Dr. Don C. Sutton stated that he considered the case interesting on account of the blood sugar. After the boy had fasted all night and until about 10 o'clock in the morning, the blood sugar was .166 grams per 100 c. c. The normal was usually considered between .09 and .10 grams per c. c. blood. In a normal person the blood sugar rarely rises above .15 after ingestion of 100 grams of glucose. Along with the .166, the boy showed a basal metabolism of +16, which was probably to be accounted for in the increase of the blood sugar concentration. For years it has been recognized that furunculosis and other skin infections very frequently show increased blood sugar, and this is also found in chronic arthritis. Frequently when the local infection and arthritis clear up, the blood sugar returns to normal, but if the arthritis does not clear up the blood sugar remains high, even though the focal infection is removed. In this case the speaker thought that one of the factors of the continued infection was the high blood sugar. On a full diet the patient did not show sugar in the urine, but in spite of that the blood sugar remained high all the time. In cases of hypothyroidism the blood sugar remains high and hyperpituitarism usually shows an increase also, following ingestion of adrenalin. In his opinion, part of the treatment should consist of a low carbohydrate diet in an effort to reduce the blood sugar within the normal range, and the patient had shown marked improvement on such diet.

Dr. Robert Sonnenschein briefly reported a case of

Facial Paralysis.

which occurred at the Durand Hospital two months ago. The patient was a boy aged eleven years, who was suffering with scarlatina. He had had an acute otitis media for ten days and suddenly showed complete paralysis of all branches of the facial nerve on the left side. The speaker realized that this was an urgent indication for operation, and did a simple mastoid operation. Within twenty-four hours there was a very slight improvement, which gradually increased, and within three and a half or four weeks function was restored, and the patient made a complete recovery.

Dr. Charles H. Long presented the following report of

Two Interesting Sphenoid Cases.

The cases which he presented belonged to the ordinary chronic suppurative variety of sphenoids, the diagnosis of which is easy, compared with those termed the closed or non-suppurative type, but not so the treatment, which is wholly surgical and often disappointing. Among the causes may be mentioned:

1. Anatomic anomalies of the sinuses.
2. Complications, local and general.
3. Sinus habit.
4. Refusal of operative procedure by patient.
5. Faulty surgical technic.

Since he had had the good fortune to familiarize himself with these anomalies by the examination of more than a hundred cadavers, he could account for the failures. Every conceivable variation may be present even to the absence of the sphenoids altogether.

Fortunately the X-ray is of considerable service in demonstrating the size and relationship of the sphenoid cells, especially when they can be filled with a solution of barium in buttermilk, as suggested by Dr. John A. Cavanaugh of Chicago, Dr. B. C. Cushway, also of Chicago, by following the method of Bond of St. Louis, has been able to give a fairly clear picture, but it is of limited assistance in diagnosing the pathology.

Local complications, such as the suppuration of adjacent cells, growths of all kinds in the vicinity must be reckoned with.

The general complications such as syphilis, Bright's disease, and diabetes, etc., all interpose obstacles to successful treatment. Again, when bacteria of a specially virulent type find shelter here, a favorable prognosis must be given with caution.

Almost every rhinologist meets with certain individuals who suffer from a chronic sinusitis of one sinus or another of one form or another, and in spite of surgery, topical applications, vaccines, tonics and change of climate, the sinus changes but little as time goes on.

The nasal tissues seem to have acquired a habit of secreting abnormal material and the physician seems helpless to eradicate this habit.

Whether we are dealing with an acquired habit of inherited condition of the tissues he was not able to state. Of course, there always remained the possibility of there being a hidden cause that had not been recognized.

In considering faulty surgical technic we are reminded that most of this is performed by the general surgeon, who cleans out normal structures of the nose as readily and as expeditiously as he cleans out a post-partum uterus. The poor deluded patient is destined to finish his worldly career with an incurable nasal catarrh, which is avoidable if the surgeon had been as conversant with the modern surgical procedure of the nose as the rhinologist.

It is only thirty-nine years ago that we were told that the sphenoid sinus "was beyond the range of manual and instrumental attack," but we are now able to carve its borders with much satisfaction to ourselves and still more to our suffering patient.

Then we have some patients who absolutely refuse any operation whatever, but thanks to the higher educational standards of our fraternity, this class of individuals are becoming more scarce.

The first case which Dr. Long presented was a woman who came to him May 22nd, 1920, complaining of noises in the ear, pounding and some deafness; she had had a feeling of closure in the ear for ten days. There was dried secretion in the mouth every morning. The nose was obstructed, especially in the right side.

An X-ray picture, taken May 26th, did not indicate sinusitis, or pus in the nasopharynx; there was no discharge from the nose. He removed the middle turbinal and exenterated the posterior ethmoid cells which contained small polypi. The pus from the sphenoid sinus was irrigated and the osteum was enlarged to about 4 by 6 m. m. A few days after the operation the ear symptoms subsided and have not returned since. From the middle of October to the Christmas season the patient was practically well.

The other case was that of a man who complained of frontal headaches. The eyes were refracted and the pain partially relieved. On November 23rd, 1920, he had the left middle turbinal, a spur from the right side of the septum and the uvula removed. A tonsillectomy had been performed in May, 1919.

Examination of the nose showed a high deflection to the left; the posterior ethmoid cells were discharging at the site of the recent operation on the middle turbinal, and a synechia between the remnant of the middle turbinal and the septum. On January 8th the posterior ethmoid cells were removed and the sphenoid irrigated, removing considerable pus; the ostea was enlarged and a small polyp removed. On March 3rd, the nasal and ethmoid walls of the sphenoid were removed.

Paper, "Pulsating Sphenoiditis."*

By Harry L. Pollock, M. D.

Dr. Frank Brawley presented the following report of a

Case of Subdural Abscess, Secondary to Sphenoid Infection

This patient gave a history of meningitis in early life. For more than ten years she suffered attacks, epileptoid in character and was very much depressed mentally, considering epilepsy to be a disgrace.

She came to Dr. Brawley for examination, at the suggestion of Dr. John R. Newcomb, of Indianapolis, December 15, 1917. At this time she was suffering from severe headache, temporal and occipital in character. Slight relief only was obtained from opiates. These headaches had followed an intranasal operation on the left side. The left eye showed great infection of the vessels of the bulbar conjunctiva and puffy red lids. The left vision was 6/12—. The visual fields showed large paracentral scotomata in both eyes.

The nose showed partially exenterated anterior ethmoid cells and a partial removal of the middle turbinal on the left side. Suction showed slight secretion in the recessus sphenoidalidis.

*See page 744.

There was rough bone in this area. The left antrum after opening and irrigation was negative. The left anterior sphenoidal wall measured 6 c. m. from the pyriform margin and this was confirmed by radiographs. The ethmoidal and sphenoidal walls were eburnated.

As suction at once relieved the severe headache, drainage of the posterior ethmoidal cells and sphenoid was decided upon. Operation on the left sphenoid and ethmoid was performed on December 21, 1917. There was moderate hypertrophy of the mucosa in the ethmoid cells and the laminae and cell walls were eburnated. The sphenoid was very shallow and when a portion of the anterior wall had been removed an opening with rough bone edges was seen in the posterior wall in the superior external region, through which the dura protruded and around the dura as it pulsated in the opening, a thin pus exuded. The distance to the floor of the subdural space was measured through this perforation and a long slot cut with the burr through the posterior sphenoidal wall near the floor for drainage. To enlarge the original opening would have made an opening impossible to close afterward. For about ten days thick greenish pus and blood drained from the lower opening. A probe was passed 10 c. m. from the pyriform margin or $3\frac{1}{2}$ c. m. beyond the posterior sphenoidal wall. Progress was uneventful. The vision improved from 6/12— to 6/5+. The enlarged blind spot contracted to normal and the entire left field of vision became normal. The perforation and operative openings were closed by trichloroacetic acid stimulation of granulations. The paracentral scotomata first observed proved to be excessive enlargement of the blind spot.

The patient returned to her home, but on March 8, 1918, came for examination because of epistaxis and pain about the right eye and ear following rhinitis. The left operative field was negative. The right sphenoid contained mucopurulent secretion which was removed with compressed air several times and symptoms subsided.

July 9, 1919, following an attack of influenza, the eyes were much inflamed with injected conjunctival vessels over the globe. There was vertical pain extending to the right ear. The cultures from the conjunctival sac were negative. The right posterior ethmoid showed hypertrophies and suction brought a thick, bloody mucopus followed by relief of pain. Vision had dropped to 6/12 in the right eye. Some vertigo and right-sided tinnitus were present. The ethmoid and sphenoid of the right side were opened and drained, and the headache and nasal drainage relieved. The visual field of the right eye was very irregularly contracted with paracentral scotomata. Vestibular tests were begun, showing lowering of all labyrinth reactions. These were not completed as the patient was given a complete rest following operation.

Following the operation on the right side, the patient remained in an epileptoid state for two hours, but was entirely normal mentally thereafter.

Dr. Brawley saw her one month ago and she stated that she had gained forty pounds and had never known such good health.

With each attack she experienced headache, markedly injected eyes and lids, short attacks of vertigo and tinnitus, lowered vision, marked enlargement of the blind spot, atypical epileptoid seizures. All these conditions immediately subsided with sinus drainage.

In searching the literature Dr. Brawley has been unable to find a parallel case; all similar cases ended fatally. No doubt the chronic nature of the infection and the fact that the staphylococcus aureus was the infecting organism contributed to make recovery possible.

DISCUSSION.

Dr. Bertram C. Cushway stated that some experimental work had been started in the Roentgen Department at the Post Graduate Hospital in an effort to work out a method whereby the sphenoidal sinuses could be shown to better advantage, but the results so far had not been as gratifying as they wished and had hoped for. There were many difficulties to be overcome in this work. They have tried Dr. Law's position for showing the sphenoid, but it did not seem very successful. Dr. Bond of St. Louis had recommended throwing the head back or propping the patient back so that the rays shot from below through the chin, and the speaker believed this was a better method.

The idea of injecting the sinuses with barium is to bring out their exact position in order to be able to figure out the proper angle, so that they could always be definitely shown on an X-ray plate or film in such a manner that they would not be confused with surrounding structures.

So far very little that is satisfactory has been done, for in most instances the barium injection ran out of the sphenoids before a picture could be obtained.

It is difficult to determine the proper angle for this work, as individuals have different contours; also the sphenoids vary in size and shape and in some instances are absent. He has purchased a little instrument to use in figuring out the proper angle and is making a series of plates, hoping to be able to get a good average angle to use on all cases. At a later date he hopes to be able to give some interesting definite information for taking sphenoid sinuses.

Dr. John A. Cavanaugh said he had reported the use of barium suspended in buttermilk, but had noticed that many of the cases after injection complained of headache. Dr. Hubeny suggested the use of malted milk and Dr. Cavanaugh found that by substituting malted milk his patients had no more headache, so has used barium suspended in malted milk entirely. After injecting the solution, Dr. Cavanaugh always places a little piece of cotton at the opening, and has had no trouble with the solution running out before the picture was taken. After taking the picture, it is a simple matter to remove the cotton. Dr. Cavanaugh, with the aid of Dr. Hubeny, has been doing considerable work along this line during the past year, and plans to present a paper on the sphenoid a little later.

Dr. Charles H. Long said he had been disappointed in regard to the cure of the case and was glad to hear someone say that it would be two years before healing could be expected. In two of the cases he dried out the sphenoid with hot air introduced by means of a eustachian catheter attached to a little electric apparatus, and then applied carbollic acid, following this by alcohol. This produced considerable reaction, accompanied by a severe headache lasting for twenty-four hours. The later effects of this treatment seemed to have lessened the discharge and improved the patient's condition.

Dr. Charles M. Robertson stated that he had seen pulsating sinuses occasionally, although they were not common. He had seen one case with pulsation from the internal carotid artery, and had heard of a case that occurred in the sphenoid sinus in which the pulsation caused the patient's death, the artery having been injured. Curettage caused a break in the carotid artery wall and the patient succumbed in a few moments. He warned that one must be very careful in attempting curettage because statistics show that in 10 per cent. of the cases the carotid artery occupies a place in the sphenoid sinus itself and where a dehiscence exists it is usually on the outer wall of the sinus. Ordinarily the carotid artery is pretty tough so it can be rubbed with the curette within bounds of safety, unless it is attacked from a lateral direction. If one keeps parallel to the lumen of the vessel there is not likely to be trouble. Cavernous sinus hemorrhage would not be as dangerous as the other. Dr. Robertson had seen the cavernous sinus torn in the Gasserian operation; the bleeding was very profuse but after a little tamponage it was easily controlled, requiring no pack. He used to think this was a very dangerous place, but after seeing some general surgeons do the Gasserian operation, he decided it was not so dangerous as he had thought. In one case he operated there was a terrific pulsation during the operation, which alarmed him greatly and he did not pursue the operation to any great extent after the pulsation began, but the case made an uneventful recovery.

As to the extradural abscess, Dr. Robertson had seen about four cases arising from sphenoid abscess. One interesting case was that of a man who had suffered with a chronic sphenoiditis for years. No history could be elicited, for the man did not seem to know much about himself; he had periodic attacks of insanity, during which he would disappear for a time and would probably be located in the gutter somewhere and would not know where he had been. He would straighten out and get along "like a good Methodist" for a while and then go away again. When he was first seen by Dr. Robertson he was in bed, the breathing was stertorous, the pupils contracted to pinpoint size and he was in the throes of death. It was impossible to examine the eyes because the pupils were so small, and when a light from an ophthalmoscope was thrown into his eyes they moved so it was impossible to see in. The temperature was 104° F., gradually ascending, the pulse was rapid and weak, and there was an appearance of profound sepsis. The only definite available symptom was the discharge running down

the posterior pharyngeal wall. The discharge was not profuse but was of the yellow varnish type seen in the suppuration of the sphenoid. The patient had been seen by several men, neurologists among others, and the diagnosis was made of a luetic gumma, tumor or abscess. Dr. Robertson told the physician in charge he thought it was an extradural abscess from the sphenoid and that he would open it if they wished. The patient was removed to a hospital and the sphenoid was opened. It was not necessary to do any preliminary operating on account of an old atrophic condition in the nose, the anterior wall of the sphenoid being in view from either side. The sphenoid was opened, then the posterior wall was broken down and as he got into the sphenoid he could see a mass on the yellow wall. In curetting the posterior wall he got into the cranial cavity, when there was a sudden gush of blood and pus, which almost drowned the man. He thought he had broken into the internal carotid and expected the man to die. The patient was turned on his side with his face down, and within a few minutes the hemorrhage seemed to have spent itself and he found he could go through the sphenoid into the extradural space. The man was operated on without ether and the next morning was conscious and able to answer questions. He went on uninterruptedly for five or six days, when the physician in charge thought he should have some vaccine and give him a shot of 275,000,000 staphylococci. This was done at 10 o'clock in the morning, and at four in the afternoon the temperature was up to 103° and continued to rise one degree per hour until it reached 108° or 110° F., and the man died. There was necrosis of the posterior wall of the sphenoid and the hemorrhage came from the basilar plexus.

In another case the patient had a false epilepsy due to an abscess in the sphenoid. The nose was first operated and the anterior wall of the sphenoid was removed, at which time a large piece of bone was removed from the posterior wall. The sequestrum was at least 1 c. m. in diameter. A little pus oozed from the space, and on introducing Shafer's curette, it dropped in to 11 c. m., being 3 c. m. deeper than the sphenoidal wall. It was an extradural abscess and the case went on to uneventful recovery.

Another case was a syphilitic otitis in which the sphenoid was destroyed so that the curette could be put down to the posterior edge of the foramen magnum. Dr. Robertson thought this was not an unusual process.

He had had one case in which the lateral X-ray picture showed what appeared to be four sphenoidal sinuses, each below and posterior to each other. He believed in that case it was a syphilitic otitis and the sinus or sinuses were small spaces hollowed out of the syphilitic osteitis. These cases improved on immense doses of antisyphilitic treatment, followed with mercury over a long period of time.

Dr. Joseph C. Beck stated that when he first tried the plan of compressing the jugular, it was purely by accident, because in that particular case he was thinking of the eye condition and

the possibility of a cavernous sinus thrombosis. In the case of the man with the exophthalmos reported by Dr. Pollock, although the fundus did not show the condition he thought perhaps there was something behind the eye balls, so he compressed the jugulars and then saw the pouring out of the pus from the sphenoid. Subsequently, in cases where there was a similar condition, this had proved to be a valuable symptom. Dr. Brawley had a patient with recovery from a condition similar to some of Dr. Beck's cases with fatal termination. He had always kept away with any surgical intervention from the posterior wall of the sphenoid when it was found to be soft or eroded. In view of the fact that there was so much danger of setting up a hemorrhage, which could prove fatal, he believed one should leave the posterior wall alone, unless one was certain that there was an abscess in that region. He believed most of these cases were syphilitic.

Dr. John Cavanaugh said he was not prepared to report this case, but would give a brief outline. The patient, a man, was thrown from an automobile about eight months ago. His skull was fractured and he bled from both ears and the nose. Hemorrhages occurred at various intervals and three weeks ago he lost two pints of blood. The hemorrhage came like a cloudburst, all at once, then stopped, and it made little difference whether the nose was packed or not; the bleeding would last for about three minutes.

Dr. Cavanaugh first saw the patient two weeks ago. He was very anemic and a transfusion was done. On examination with the pharyngoscope, pulsation could be seen, evidently in the sphenoid area on the right side. On the left side there was nothing abnormal; the septum was pushed over, due to the pack on the right side. Dr. Beck, Dr. Iglauder of Cincinnati and Dr. Perry Goldsmith of Toronto examined the patient very carefully, and nothing definite was decided except that the packing should be continued.

The source of bleeding was still a question. A postnasal pack moistened in Monsel's solution was used, and changed every few days. The patient had improved somewhat since the packing was used and the headache had not been so severe. The coagulation time was five minutes. Partial optic atrophy of the right eye was present. The wife stated that about two months after the accident, after the patient had left the hospital, she noticed that there was a distinct bruit which she heard four inches from his head. She did not know how long the sound had been present. The Wassermann reaction was negative.

Dr. J. Holinger reported the history of a woman who had been treated during four or five months by a Christian Scientist for chronic headaches on the right side with gradual loss of vision in the right eye. The vision became so bad that she had to give up her work and the eye felt as if it was frozen. A sensation of total numbness was present. Examination showed that she could not count fingers at close range with the affected eye. The left eye was normal. Roentgen examination showed increased density over the whole right side, frontal ethmoid,

sphenoid, and maxillary sinuses. The patient was first seen by Dr. Holinger two weeks previously; when intranasal examination showed almost normal conditions, especially no pus could be seen, either medial or lateral of the middle turbinal. The middle turbinal was not enlarged and pinkish. The patient could breathe through the right side most of the time and there was no difficulty with the left.

The middle turbinal was removed, the history and the X-ray findings made it necessary. A large mass of granulations was found underneath the turbinal. When the rear end was removed there was a gush of very foul smelling pus, and in the midst of the operation the patient suddenly brightened up and said, "I am beginning to see!" This first improvement in vision was temporary. It became permanent during the next few days when the condition cleared up, and the foul odor disappeared after daily washings with boric acid solution. There was very little secretion now and the vision had improved until it was equal in both eyes. The sphenoid was side open, so that one could see into it, and the patient returned to work.

Dr. Holinger explained that the course of this history seemed to throw some light on the question whether the loss of vision was due to pressure against the optic nerve or to poisoning of the surrounding tissues from the accumulation of decomposed pus in the sphenoid and posterior ethmoid sinuses. The sudden improvement as soon as drainage was effected, the disappearance of the improvement when a bloodclot filled the sinuses towards the evening of the first day after the operation, and, finally, the permanent and gradual improvement when in the course of ten days of the after treatment, the blood-clot and the secretions were gradually removed, all speak for pressure as the cause of the loss of vision. If poisoning of the tissues had been the cause, the course would have been different.

Dr. Harry Pollock said that Dr. Beck had covered the points about curettage in any case of sphenoidal trouble. He agreed with Dr. Beck that it is always dangerous to do any curetting on the posterior lateral wall for fear of injuring the carotid or cavernous. Dr. Pollock had never seen a case of cavernous bleeding by curetting the sphenoid. He had reported a case of suspected intracranial tumor before the Chicago Neurological Society. While investigating the sella there was a sudden rush of blood which almost exsanguinated the patient. They packed in gauze, with stitches through the dura and scalp in order to get the patient back to her room before death occurred, but about twenty minutes afterward she said she felt fine and she made an uneventful recovery. The gauze was removed gradually and the patient lived for at least a year, and gave birth to a child during the year following operation.

In the second case Dr. Long had showed Dr. Pollock detected a slight pulsation. The patient said it hurt her nose a little to dilate the nostril so he did not attempt to make a thorough examination. He believed if the jugulars were always compressed more cases would be found than were usually suspected.

In taking a spinal fluid and blood Wassermann tests a luetic

infection is discovered in almost all of these cases, and in those cases Dr. Pollock thought there was always a necrosis, an osteitis of the floor of the lateral wall of the sphenoid, which went down to the body, probably to the basilar process. All these cases required a long time for recovery and all of them had received treatment with mercury and potassium iodid for at least a year, and all but two cases finally cleared up.

Dr. Alfred Lewy said he had also noticed the pulsation in the case of Dr. Long's and asked if Dr. Long had any explanation to make of the condition. To what did he attribute this pulsation of the mucous membrane.

Dr. Charles H. Long said he had not noticed the pulsation until his attention was called to it, and had no explanation to offer.

Dr. Frank Brawley stated that in his case repeated Wassermann tests were negative, there was no evidence of syphilis at any time, although the patient was examined most exhaustively, and there was no history of syphilis in the case. More than three years had passed since the drainage of the extradural abscess.

About two weeks previously he had seen a case with similar characteristics. There was very severe headache, which the patient attributed to the use of homatropin in refraction. There was some delay in gaining consent to examine the sinuses, but when this was permitted, he found pus streaming down over the anterior walls of both sphenoidal sinuses and from the posterior ethmoid region of both sides. The headache was so severe that after a few days the patient consented to operation. Both sphenoids and posterior ethmoids were opened and pus was found in large amount in all the cells. Roentgenograms taken before operation showed a very hazy area in the region of the sella and the posterior wall was nearly gone or enveloped in pus. No necrosis was present on the posterior wall of either sphenoid. The patient and his friends were hard to control and it was impossible to get the patient to remain in the hospital. They were able to get only one picture after the operation and that showed almost the same condition that had existed before. It was impossible to get the patient's consent to further operation, although Dr. Brawley thought the case might possibly be similar to the one he reported, or that it might need drainage though the posterior wall.

CHICAGO LARYNGOLOGICAL AND OTOLOGICAL
SOCIETY.

Meeting of April 4, 1921.

THE PRESIDENT, DR. ALFRED LEWY, IN THE CHAIR.

Presentation of Cases.

Dr. Charles Robertson presented a case of Vincent's angina. The patient had first noticed his disease four weeks previously, at which time there appeared a slight ulceration of the right tonsil. He became progressively worse despite the use of mouth washes containing chlorin. Dr. Robertson had first seen the patient on the day of presentation and exhibited him so that the younger members might see the condition present. The ulceration was sharply outlined, the edges undermined and irregular; it occupied the position of the right tonsil, the posterior pillar extending into the soft palate nearly to the base of the uvula, the uvula being swollen and elongated. The upper pole of the tonsil was almost destroyed, the posterior pillar was lost in the middle portion by the ulceration and the process was extending along the posterior wall of the pharynx. The only subjective sign was pain on deglutition. There was no rise in temperature, no involvement of the Eustachian tube with attendant ear pain and no involvement of the cervical glands. A smear showed a great preponderance of fusiform bacilli and spirillae, almost a pure culture.

The ulcer was very similar in appearance to a luetic ulceration, a point of interest in the diagnosis.

Dr. Robertson said the best method of treatment for Vincent's angina was the use of powdered salvarsan, salvarsan in solution swabbed on the ulcer, or salvarsan administered intravenously. He expected in this case to use a 20 per cent. solution of methylene blue, painting it onto the ulceration and getting it into the interstices as far as they went. He reviewed the epidemic of Vincent's angina during the war and stated that the use of methylene blue proved very successful in the management of these cases.

Resonators as Possible Aid in Tuning Fork Tests—A Preliminary Report.*

By Robert Sonnenschein, M. D.

DISCUSSION.

Dr. J. Gordon Wilson said that he had a clear recollection of the previous paper of Dr. Sonnenschein's to which he had referred. In that paper he propounded some puzzles in acoustics. In the paper tonight he had returned to this subject and left a few more puzzles to engage their attention. It was certainly astonishing to hear that while one could with the resonator magnify a tone, yet there were some diseases of the ear in which the hearing of that note

*See page 703.

from the resonator was not bettered. One would like to hear a little more about this.

In regard to the question of the relation of tinnitus to the ear lesion, Dr. Wilson had seen cases where it had been possible to localize the pitch of the tinnitus and in some of these cases the pitch of the tinnitus had a very important relation to the nerve involvement. How far further work would bear this out must be left to the future to determine.

Resonators in the study of the physics of hearing have been much used in the past, and the great work of Helmholtz was to a large extent based upon his use of resonators. In drawing deductions one, of course, must recognize that while resonators increase the intensity of the pitch to which they are attuned, they also magnify the amplitude of the corresponding overtones and the corresponding subtones.

Dr. Sonnenschein had drawn attention to a field which otologists have neglected. Dr. Wilson was confident that otologists would pay more attention to the cochlea and audition in the coming years. The cochlea offers a fertile field for investigation, much as the labyrinth did a decade or more ago. One would like to hope that from such work an increased knowledge would come to audition comparable to the knowledge which has come to us of the vestibular mechanism.

Dr. J. Holinger was not sure that it was permissible to say that the resonator increased any one particular sound, in the sense that it increases the amplitude of the vibrations. Through its size and configuration the resonator shuts out other sounds, and the one particular sound for which it is made is concentrated through reflection on the inside of the resonator and through the given volume of air which is in that special resonator. In order to increase or intensify a certain sound, that is, to increase the amplitude of the vibrations of that sound, new energy would have to be added to the sound, and a resonator does not produce energy.

Dr. George W. Boot said that we must consider the forces as well as the frequency of the vibrations. The amount of sound depends on these two factors, i.e., the amount of force is the product of the amplitude of the vibrations by their frequency. The resonator shuts out all sounds except the pitch to which it is tuned, hence that particular pitch is heard better.

The reason why the sound to which the resonator responds is not heard better in otosclerosis is probably because the sound is not really more forcible, but because other extraneous sounds are kept out by the resonator and these are the sounds that ordinarily would start the stapes to vibrating and permit the resonator's pitch to enter. If the resonator actually made the sound louder it should be better heard in otosclerosis, but if it only seems louder because other sounds are kept out, it is easily seen why it does not improve the hearing in otosclerosis.

Dr. Norval H. Pierce was surprised to learn that bone conduction was not increased by the resonator in cases of otosclerosis, and wondered whether the same experiments could not be made on bone conduction to see whether the resonator prolonged the bone conduction. It suggested a very interesting thought that by means

of resonators we might be able to eliminate bone conduction in our experiments. One would think that in the use of resonators there would be a certain amount of bone conduction if the resonator was in contact with the bone of the auditory canal, but this did not seem to be the fact.

Dr. Alfred Lewy asked Dr. Sonnenschein to explain in just what manner the resonator apparently increases the sound. There appeared to be a difference in the meaning of certain terms rather than a difference in the actual facts in the case.

Dr. Sonnenschein (closing the discussion) thanked the gentlemen for their kind discussion, and said he was always glad to hear from Dr. Wilson, who had had so much experience in physiology and physical research. It is a fact that every tone has overtones. The first is the octave of the tone used, the next is five tones above that, and the next overtone is two octaves above the original tone. Often there are five overtones or more, the principal ones being the first three mentioned. He stated that resonators increase or reinforce sounds that have the same pitch as the fundamental tone or multiples thereof. It must be taken into consideration that when the tuning fork is used, the resonator increases the overtone as well as the fundamental tone itself, but the latter is most intensified. The fact that the cochlea is being subjected to very serious study at present is gratifying, especially as in the last few years the vestibular apparatus has claimed most attention.

Replying to Dr. Holinger, the speaker said he realized that one could not create energy or matter and cannot destroy it, but one can transform it. If a troop of infantry has to cross a bridge they are always commanded to break step so that the bridge will not be made to vibrate and possibly collapse. The same is true of the resonator. It picks out the tone which corresponds to its fundamental note and the repeated impulses coming at the same moment causes a reinforcement.

As Dr. Boot stated, there can be a change in the force and extent of the amplitude and thereby again changes in the intensity of the sound, making it louder.

Replying to Dr. Pierce, the two cases of otosclerosis were typical and yet the hearing was not increased at all by the resonator, which intensified the tone of the a' tuning fork.

The work had been carried out on only fifty cases, and Dr. Sonnenschein said he was not in a position to completely analyze the physical basis on which it rests. He regretted that he is not at present in contact with Professor Schaefer, in whose laboratory he had learned many important facts. Only by further study can the subject be elucidated and he is making a humble effort toward this end.

Dr. Charles Robertson read a paper on

A Review of the Medical Aspects of Aviation.*

By Charles M. Robertson, M. D.

DISCUSSION.

Dr. George W. Mosher stated that he had the privilege of working with Dr. Robertson in the original testing and also of going through the Training Camp at Mineola, and as Flight Surgeon in

*See page 776.

Texas, where he put in about 100 hours flying. With the experience gained from these three ends he could corroborate what Dr. Robertson said. Probably 90 per cent. of commercial flying will be done under an elevation of 5000 feet and oxygen lack is not a factor until one is beyond that elevation. The rebreathing test is important, for if a man is to be a pursuit flyer at 20,000 feet, he must be able to stand that, but a little cold in the head, loss of sleep or a little indigestion will make a difference of 2,000 to 4,000 feet in a test record, and is of no great importance for commercial flying. The tests of the labyrinth are important. A functioning labyrinth must be a part of the man's equipment and without a perfect functioning labyrinth one cannot be sure what he will do, but a properly functioning labyrinth is of no great value to a man unless all other impulses come in right; muscle sense, vision and tactile sense when air currents strike on the cheek and in the face. It was Dr. Mosher's unpleasant duty while a flight surgeon to take off of flying permanently three different men who had passed "A" grade, which meant there was no limit to the man's endurance, according to the rebreathing test, and he could pass perfectly in the rotation chair. These men were all right in taking the ship off the ground and were all right in any altitude, but if they threw a ship into a side slip and came down in "nothing flat," those men—apparently through nothing that he could find except the sudden change in pressure—would lose control of themselves. Those men with a blood pressure of 130 m.m. of mercury before they flew had 90 m.m. of mercury afterward. Whether this was "nerves" or a direct result of failure of the circulatory apparatus, the fact remained. They were men who were absolutely unsafe, and yet their rotation tests and rebreathing tests showed them to be of the highest type.

Dr. Mosher thought the important thing to bear in mind was that the otologic test for fliers had been played up as the most important in Governmental work, while the fact is that the result of sudden change in atmospheric pressure, as experienced in actual flight, is more important than anything that a man will show in a rotation chair or in rebreathing tests; in his judgment, too great importance has been attached to repeated tests of labyrinth, and to rebreathing tests, and altogether too little value placed on the results of rapid changes of atmospheric pressure.

Dr. J. Gordon Wilson said he had listened with interest to Dr. Robertson's paper. Dr. Wilson's experience with the fliers had been early in the war, when our knowledge of the relation of aviation to otology was still very hazy. Looking back to that period, it is evident that otologists have journeyed far from the position they held in 1917. To mention but one example, it is recognized that some tests believed then to be of prime importance are now considered much less essential. It has been recognized that the stress laid on nystagmus and in past pointing have not the importance that one thought they had, and no one, so far as he knew, has demonstrated that nystagmus and past pointing are related to flying ability.

Dr. Wilson thought Dr. Robertson was mistaken in saying that the authorities in Washington had said that the vacuum chamber

was no good. Dr. Wilson believed it would be more correct to say that they believed a vacuum chamber gave accurate scientific data, but that it had been found by experience that such chambers were not suitable for routine examinations.

In regard to the question of oxygen tension, everyone who had anything to do with aviators was aware of the importance of oxygen. Dr. Robertson had spoken of men coming down exhausted and sleeping for hours. It had been found that if these men were supplied with oxygen, they quickly revived and showed less after-fatigue. What one desired was to ascertain the essentials necessary to safe flight and how, under the various conditions arising during flight, this safety mechanism could be disturbed, and how against such disturbances the flier could be safeguarded. Though recognizing fully the importance of alterations in atmospheric pressure with the resulting alteration in oxygen tension, yet Dr. Wilson was not inclined to give as much importance to this as Dr. Robertson does. Dr. Wilson believes that of more essential importance in determining the ability of a man to fly are (1) his ability rapidly to coordinate the afferent impulses coming in from the ear, the eye and the kinesthetic senses, which are the impulses so essential to balancing, and (2) the control, largely automatic, which the aviator develops over this coordinating mechanism. It is this control, this automatic adjustment of the afferent impulses and their efferent responses, influenced undoubtedly from higher centers, which is conspicuously present in our best fliers and faulty when the flier goes stale.

Dr. Frank F. Novak, Jr., asked how the matter of nystagmus time was observed in this work. The method of looking at the eye from the side and timing it with a stop watch was unreliable and grossly inaccurate. A much better plan is the use of a reading microscope mounted on the side to observe the nystagmus movements, but even that is not as accurate as another method which had been devised at Urbana, that of using a "singing flame." This is simply a gas pipe with a small jet. The gas flame is about the thickness of a match and about one-fourth or one-half inch high. Over this flame is passed a glass tube of a definite length. The flame vibrates and produces a tone like a high pitched tone of the organ. In a dark room, looking straight ahead, one sees just one streak of flame, but if the eyes are moved from right to left it is no longer a single flame but a jagged series of lights. That is applied in measuring nystagmus time, depending upon the report of the individual whose nystagmus is being measured. While the nystagmus lasts, instead of seeing a single flame the individual sees a jagged series of flashes. When the nystagmus stops he sees only a single flame. This is one of the most accurate methods of measuring nystagmus that has been discovered to date. The work is being done by Bentley and Griffith at the University of Illinois.

Dr. Norval H. Pierce said he had not had much experience during the war other than turning something like 2,000 aviators in testing their labyrinth function. He believed the whole thing is a matter of development, and that we probably will arrive at entirely different conclusions in the future than those arrived at during the

stress of war, but that the Department did the best it could in testing out aviators by the methods adopted.

Dr. Pierce asked Dr. Novak how long a nystagmus, which is considered normal, is found by the use of the singing flame, and what was the difference between the character and duration of nystagmus as measured by the ordinary methods and that measured by the singing flame.

Dr. Novak (replying to Dr. Pierce) said the test was rather characteristic. The time was greatly lengthened; he could not tell the number of seconds exactly but the reading by means of the vibrating flame is considerably longer than with the eye. If four or five observers watch the same eye and click their watches, there is a variation sometimes of three, four or six seconds, and sometimes the nystagmus ceases, but looking at it closely one sees a little left—a fine fibrillary twitching. The jagged light is very pronounced at first, then gradually gets finer, then ceases for a second, and then stops with a very fine motion.

Dr. Pierce thought this test by the singing flame seemed to depend upon the subjective sensation of the individual and believed he would rather depend upon the old method in examining recruits for aviation than to trust to a man's reported sensation. The inhibition of nystagmus is very interesting and is one of the problems being actively investigated at present. In the opinion of Dr. Pierce, there is an inhibitory mechanism which is disconnected from the will than enters into this phenomenon, and that belief is based upon the fact that when a man is turned and he vomits, the nystagmus ceases immediately the vomiting occurs. The nystagmus does not diminish but ceases instantaneously, and Dr. Pierce did not agree with Dr. Wilson that this is altogether a matter of control, but considers it a matter of automatic inhibition. He believed control could be cultivated under the will. There are two factors, a subconscious inhibitory mechanism and also a mechanism which is directly subservient to the will.

Dr. Wilson, replying to Dr. Pierce, said that control comes from the highest senses to the lower senses; call it inhibition or what one likes, it is control.

He thought Dr. Novak would photograph the method he described and get it under black and white, and thus do away with the things Dr. Pierce objected to. In his opinion Dr. Novak had something worth working out.

Dr. Charles M. Robertson stated that the reduction of nystagmus is not in the Army Medical Book. That was in the paper on the results of his investigation, which was published three years ago. In the Government book the statement is made that nystagmus will be lessened on repeated turning, but it does not give any figures at all. Dr. Robertson found the diminution in vertigo or in nystagmus after placing a man in a vacuum chamber for six minutes and taking him out was equal to 50 per cent. in most cases. There could not be any inhibition or control in that length of time, the man did not know what he was doing and one seance was not enough to educate him on control. The usual stop watch method was used in taking the nystagmus time and they could not be expected to have used a singing flame, as it was unknown

three years ago, and he would not adopt it now as there were more desirable tests which did not rely upon the patient's response, which would not be accurate.

When they tested a man of average intelligence they had the man signify when his vertigo disappeared. They were never four seconds out of tune on the nystagmus period and the nystagmus time as experienced by the man and taken with the stop watch was almost the same, never being of appreciable variation. If one said to the man, "When your vertigo ceases say 'Now,'" he would say "Now" just as his eye motions would stop. That became to Dr. Robertson constant enough that in actual work in the field he would not look at the man's eye at all, and the same man tested over and over would not vary a second.

Regarding the reduction in vertigo by the vacuum test, one test of six minutes duration was not enough to train anybody in anything, but at the same time the vertigo was reduced. Even if there was a mistake of three seconds, as suggested by one speaker, in 30 or 40 per cent. the vertigo was less than before. A man who had a pulse of 72 and a blood pressure of 80D—120S—there were certain types of men who, when they come out, had a diastolic of 90 and a systolic of 140 and the nystagmus was practically the same. On the other hand, a man who went in with 80 diastolic and 130 systolic would come out with a diastolic of 70 and a systolic of 120, and his nystagmus much reduced. In other words, some were stimulated with the stimulation in the labyrinth with a rise in the blood pressure, some with a quickened pulse, some with lowered, but most with the quickened and the nystagmus the same, while, on the other hand, the blood pressure was depressed and the muscle tone depressed with the nystagmus shortened. Dr. Robertson recalled one big man who went in with a pressure of 80 diastolic and 135 systolic and came out with the nystagmus just about normal, but who had a syncope which lasted for several minutes and the systolic pressure 90 and the diastolic something like 50. Muscle fatigue can be tested more accurately with the accommodation or "near point", which is a very good test.

Dr. Robertson thought it looked as though there was in some an increase in the blood content of the labyrinth—a hyperemia and, therefore, an increased activity of the labyrinth—while there was an anemia in the labyrinth in the cases of reduction of the nystagmus due to a less stimulated labyrinth. That is his impression at present. The man that is stimulated when he goes into the air is the man who is going to come back. The man whose blood pressure is depressed is on the road to syncope and anemia in the entire body with the labyrinth which, if it continues, causes the man to become unconscious and that is the end of it as far as his flight is concerned.

Dr. Robertson had no intention of criticizing the Government; he thought they did their best, but believed they were barking up the wrong tree. He had had quite a lot of correspondence and conversation with the Department, which had all been friendly and not antagonistic.

Another point to be considered was the loss of carbondioxid in the blood. In a conversation with Prof. Green of the University

of Missouri, it was agreed that he would take up this proposition at Mineola and see if there was anything in it, but it was never done. He had taken the vacuum test at Mineola and thought it was not good. The vacuum chamber was large and the pump was not powerful enough to produce conditions similar to flight. One man would take oxygen, some none, and some a little, and Dr. Robertson thought he was fair in saying that the test was of little scientific value therefore. He thought he was fair in stating his opinion, as the matter is a scientific question and anyone had a right to express his opinions. He was conversant with what the English thought of it, and Birkley had said that the oxygen want was not of so much importance as it was thought to be. It seemed to Dr. Robertson that the blood pressure change is the dominant factor.

THE COLORADO CONGRESS OF OPHTHALMOLOGY
AND OTOLARYNGOLOGY.

Meeting of July 23 and 24, 1920.

ABSTRACT OF PROCEEDINGS OF THE OTO-LARYNGOLOGICAL
SECTION.

Infected Tonsils and Their Sequelae.

By Lewis Emmitt Brown, M. D.,
Akron, Ohio.

The tonsil is one of the greatest avenues of focal infection. Fau-
cial tonsil infection may be the origin of the following conditions:
Articular and periarticular rheumatism, endocarditis, myocarditis,
pericarditis, neuritis, perineuritis, nephritis, pleuritis, tubercular
adenitis, disease of the labyrinth, jugular or sinus thrombosis,
gastrointestinal diseases as gastritis and duodenal ulcers, various
eye lesions, chorea and poliomyelitis.

Strong emphasis is made of the necessity of a thorough examina-
tion of each tonsil in all suspicious cases. Pressure should be ex-
erted to expel the secretion from the crypts and, when indicated,
smears of this excretion should be examined by a competent lab-
oratory man. The size of the tonsil has little or no bearing on the
infectivity. The smaller tonsils frequently contain blind abscesses
from which absorption takes place; they may hamper the function
of the eustachian tube and retard free drainage from the nose and
upper pharynx.

Tonsillectomy may relieve obscure conditions such as Basedow's
disease, otosclerosis, and persistent thymus.

Systemic sequelae must be appropriately treated when present.

Contraindications to tonsillectomy are: Acute inflammation or
infections, advanced tuberculosis, cardiovascular changes, diabetes
mellitus, luetic ulcerative processes, low coagulating power of the
blood, high blood pressure, infants under one year of age and some
grave mental diseases.

Complete removal of the tonsil with the capsule is emphasized.
It is indicated in all cases of repeated tonsillitis where the tonsils
are suspected of being foci of infection, on finding pus or the con-
stant formation of cheesy plugs in the tonsil.

Summary.—1. The infected tonsil, more often than not, is the
source and causative factor in the production of certain diseases.

2. It behooves each and every one of us to be more careful and
exact in our examination of all suspicious cases.

3. We must not be misled by the size of the tonsil, but must
closely observe the condition of the tonsillar tissue, the secretion
from the crypts and the general disease existing.

4. We must not forget that the systemic infection has already oc-
curred and that the removal of the tonsil is merely removing the
source of infection and is not an attempt at curing the systemic
malady.

5. There are only a few contraindications against operation.

6. If the slightest doubt exists as to the source of infection, the teeth, sinuses, gall bladder and genitourinary tract having been eliminated as foci of infection, then circumstantial evidence is usually sufficient to justify complete enucleation of the tonsil.

DISCUSSION.

Dr. W. R. Thompson, Fort Worth, Texas: I agree with Dr. Brown concerning the insignificant appearance of the tonsils in some cases with marked systemic manifestations. One of the most aggravated cases I ever saw of rheumatism resulted from tonsils which were almost indiscernable.

Dr. H. I. Lillie, Rochester, Minn.: I feel that at the present time we know very little about it. Dr. Brown has pointed out that there are two types of focal infection, referring to primary focus and a secondary focus. I think that this is well borne out in the case of arthritis where there apparently was no beneficial effect from the removal of the tonsil, which had been said to be in some cases the primary focus; until after the boy has been able to fight off the systemic infection. Glands in the neck secondary to the tonsils may act as secondary foci, so in our search for a possible focus for any given lesion we must not content ourselves with the mere examination of the teeth and tonsil, but we must have our internists go over these patients very carefully.

Dr. L. E. Brown (in closing): Mr. Chairman, I think, in closing, the only point that I want to make clear is in answer to Dr. Loeb, that I simply use the tonsil and the conditions existing in the tonsil as one of the possible sources of very systemic conditions that we encounter. That was the actual experience in every case.

The Relation of Nasopharyngeal Malignancy to Other Diagnosis.

By G. B. New, M. D.,
Rochester, Minn.

In the author's review of forty-six cases of malignant tumors of the nasopharynx observed at the Mayo Clinic, he has been particularly impressed by the lack of nasal symptoms and the frequency with which such growths were overlooked before a correct diagnosis was made. The tumors include the sarcomas and epitheliomas but not the fibromas and myxomas. There were twenty-two cases of epithelioma, fourteen of sarcoma, and ten of other malignant tumors unnamed. In the diagnosis of lymphosarcoma it may be difficult for the pathologist to corroborate the clinical diagnosis without taking several specimens. The patients' ages varied from ten to seventy years; 50 per cent were between the ages of forty-one and sixty. Thirty-eight patients were males and eight were females.

The symptoms varied in duration from five weeks to three years. They were referable to pain in the ear and over the face and head, gradual loss of hearing, drooping of the eyelid, diplopia, nasal obstruction, enlarged glands of the neck, and so forth.

Seventeen patients complained of headache, earache and other sensations of pain which were always on the affected side, and ex-

tended in general to the frontal, temporal, mastoid, or cervical regions. In cases in which the gasserian ganglion was involved, there were symptoms such as pain, numbness, and tingling, over the distribution of the nerve.

Ten patients had eye symptoms such as ptosis of the upper lid, diplopia, pain about the eye, different forms of ocular palsies and varying degrees of blindness, due to extension of the tumor into the orbit.

Ear symptoms were present in eleven cases. These were fullness in and posterior to the ear, ringing and noises in the ear, earache and deafness. These symptoms were caused by the growth involving the Eustachian tube.

Eleven of the thirty-two patients who had enlarged glands of the neck were operated on without discovery of the primary growth. On microscopic examination three of the growths were diagnosed endotheliomas. A clinical diagnosis of Hodgkins disease was made elsewhere in three cases. Extensive metastases sometimes occurred in the neck following a small primary growth in the nasopharynx. The upper cervical glands were always involved first and in some cases glands were involved on both sides of the neck.

A fact especially noted by the author was that in only twenty-four of the forty-six cases were the symptoms referable to the nose and nasopharynx. In nineteen of these there was a complaint of nasal obstruction, in three recurring attacks of bleeding, and in two increasing nasal discharge. Lack of these symptoms was due to the superficial character of the growth which appeared in the vault or lateral wall of the nasopharynx. In some cases the growth appeared as a small ridge or flattened ulceration, and in others it was large enough to fill the nasopharynx, bulging the soft palate and causing pharyngeal obstruction. This was particularly true of the sarcomas.

On account of the variability of the symptoms present with these tumors, some of the patients were subjected to various operations and treatments elsewhere, such as extraction of teeth, treatment of syphilis, removal of the glands of the neck, paracentesis of the ear drum, intranasal operation, tonsillectomy and operation for pituitary tumor, without the presence of the nasopharyngeal tumor being discovered.

The author particularly emphasizes the importance of making a careful examination of the nasopharynx in all cases in which any of the foregoing symptoms are present, especially when there are glands in the neck that may be malignant. Patients with neurologic symptoms referred to the eye, or ear, or patients with intracranial symptoms, should also have a nasopharyngeal examination.

DISCUSSION.

Dr. Thompson, Canon City, Colo. (opening): I think the oculists should have credit for a good deal of this, because they are the ones that send the throat man the cases where there is something the matter with one eye for diagnosis. I know that if I send one I send fifty cases a year to the throat and nose man to see whether there is any trouble in the sinuses—either the ethmoid or sphenoid sinuses, and I am pretty sure that there will be something there

because of the peculiarity of the blindness and the visual field. What we are most solicitous about is that when the return is made to us of the condition, that there will be some reliance to be placed on it. Nearly every one of these cases goes through the hands of the otolaryngologist first, and then the X-ray man, and when the return comes to us we want to have it as certain as the Wassermann test.

I have seen quite a number of cases of tumors of the nasopharynx. Some of them may have been benign tumors, I do not know, but some of them have died. These things are beginning to be common now because of the solicitation on the part of the oculist.

Robert Levy, M. D., Denver, Colo.: This is a subject concerning which our knowledge is rather limited, and I feel my incompetency to discuss it, particularly after listening to this report of forty odd cases of so uncommon a condition. However, this may not, perhaps, be as uncommon as we have believed, being only apparently so because it is not recognized.

The recognition in the early period of nasopharyngeal growths is extremely difficult, most of them being diagnosed only after they have advanced to a degree sufficient to produce pronounced symptoms, symptoms having reference especially to the functions of hearing and breathing. Other more or less obscure symptoms escape our attention, and occurring as these neoplasms often do in children, physical signs are not determined easily, owing to the difficulty of carrying out a satisfactory nasopharyngeal examination. Palpation is our best method of examining children, but this is not always dependable.

Where my attention has been definitely drawn to the nasopharynx, the condition appearing obscure, the nasopharyngoscope has been of much help in determining the location and character of the lesion, and if we are on the alert for tumors in this region we often will be able by this method to arrive at an early diagnosis.

Dr. William L. Benedict, Rochester, Minn.: I think ophthalmologists should be particularly interested in learning that twenty per cent of the cases described by Dr. New had symptoms definitely referable to the eye; in fact, some of them came for ocular imbalance or blindness, the cause of which might easily have been ascribed to constitutional disturbances or intracranial lesions.

The early diagnosis of ocular disturbance is becoming more involved as we learn more of the cause of the symptoms which so closely resemble symptoms of brain tumor. The invasion of the orbit in these cases must necessarily be by direct extension of the tumor mass into the orbit, often through the paranasal sinuses. An early symptom of nasopharyngeal tumor is paralysis of an external rectus muscle or ptosis.

Dr. Edward J. Brown, Minneapolis, Minn.: One of the gentlemen mentioned a series of twenty-seven cases that were published quite a number of years ago. I think one of those cases was mine. Many years ago—I have forgotten the details now—a man about fifty years of age came to me with no complaint except earache, having been in more or less pain for some weeks, possibly months, in both ears. I found a smooth, rounded growth perhaps three-quarters of

an inch in diameter in the vault of the nasopharynx, having every appearance of being an adenoid, and in my youth and inexperience, I proceeded at once to remove it. I submitted the growth to a pathologist, who reported it as carcinoma. The man came to me but a very few times following that, and I lost track of him. His wife wrote to me some months later that he had died.

Dr. Gordon B. New, Rochester, Minn. (closing): I believe that Dr. Loeb's point is true that most of these patients are seen by the general surgeon first; many are also first examined by the medical consultant. The neurologist and ophthalmologist sometimes see them in consultation.

I think I answered Dr. Levy's question with regard to the possibility that some of these patients have malignancies of the sphenoid, in my paper. Most of these malignancies are situated laterally above the eustachian tube in Rosenmuller's fossa, are quite small growths, and are in no way connected with the sphenoid. It is impossible to determine just where some of the larger growths originate.

The Closed Method of Dealing with Tonsillectomy Wounds.

By John O. McReynolds, M. D.,
Dallas, Texas.

The paper emphasizes the following points:

1. It is the aim of surgery in all parts of the body to secure complete primary union if practicable, reducing the granulating area to the minimum.
2. Rational modern surgery is asking the question: Is it necessary to deliberately convert a clean tonsillectomy wound into an open granulating surface?
3. Reasons are presented for an immediate and complete closure of the tonsillar wound, obliterating the fossa by bringing in proper apposition the denuded surfaces of the palatoglossus, the palatopharyngeus and the superior constrictor of the pharynx, together with the overlying mucous membrane.
4. Nature never made an open tonsil fossa. Man is the originator of this condition.
5. Abundant experience has shown that immediate closure of the tonsil fossa not only contributes to our greatest security against all forms of hemorrhage, but also promotes the healing of all wounded strictures without the interference of unnecessary scar tissue which would restrict the free movement of the pharyngeal muscles.

DISCUSSION.

Dr. F. L. Dennis (Colorado Springs, Colo.): A few years ago I adopted the practice originated, I believe, by Dr. Joe Beck of Chicago of suturing gauze in the tonsil fossa. I believe I am correct in saying that Dr. Beck has now given this up, and I am sure I have, principally on account of the discomfort to the patient for the ensuing twenty-four hours.

It seems to me that we ought to bear in mind what we are striving for as an end result from tonsillectomy. In the first place, we

want to get the tonsil. That, of course, is self-evident. In the next place we want to have smooth healing, with as little scar remaining as possible; we want to preserve all the pillars, and we want to leave them just as free in their action as possible.

Thinking about the thing simply in a theoretical sort of way, it seems to me that Dr. McReynolds' procedure does not fulfill our needs. I do not see how binding the tissues together and forming one mass of the pillars and the muscles can preserve the individual action in these muscles.

Now, going back again to another reason for doing this: Dr. McReynolds spoke of the control of hemorrhage. That I take it, was the reason that Dr. Beck adopted this plan of suturing gauze in. However, I don't believe it is necessary. I think that suturing the bleeding points at the time of operation will give us a very satisfactory and comfortable feeling about the subsequent hemorrhage.

To go back again to one of the results which we desire in tonsillectomies—that of preserving the pillars and preserving the wound in a perfectly smooth condition without contraction by scar—I think it is of the utmost importance to preserve the mucous membrane which lies at the summit of the tonsil fossa. Where this is carefully done the mucous membrane quickly spreads over and covers the raw surface, and we get an ideal result in scar formation—I mean no distortion, because there must be scar formation.

One of the objections which, it seems to me, might be urged against this method of suturing pillars together is the fact that while we may have a clean wound at the end of the operation, I do not see how it is possible to keep it clean when we consider the infected area in which the wound lies.

Dr. W. R. Thompson, Fort Worth, Texas: With reference to Dr. McReynolds' operation of closing the tonsil wounds, I wish to say that I believe Dr. McReynolds is after end results. If bringing the pillars together will give us better end results I think it is what we want; and knowing as I do Dr. McReynolds' soundness on every point that he advocates, I am very much inclined to have the doctor at least give us further reports on his technic and results.

Dr. Edward J. Brown, Minneapolis: I would like to say just a word: A few weeks ago I removed a tonsil of a young bank clerk, and when I severed the main vessels there was a sharp hemorrhage. I forced the tonsil back into the fossa and held it there for a few moments and the bleeding ceased. Just a week after that he came into the office spitting blood with quite a sharp hemorrhage which required a considerable amount of time and manipulation to control.

Some years ago my small boy a dozen years old had bronchopneumonia. The family physician—a very skilled man—advised me to remove his tonsils. His tonsils were the smoothest, cleanest looking pair of tonsils I ever saw in a child's throat, I think. But I removed one of them as soon as he was fairly over his bronchopneumonia. The following day there was a very considerable swelling of the lateral tissues and he proceeded to get a sharp infection which left him with a damaged heart. I said to the intern-

ist: "I am not willing to treat my own children, or other people's children, without some safeguard against that kind of result." "Well," he said, "I have been telling the nose and throat men for years that they have no business to remove tonsils without preparing their patients by vaccine treatment." Ever since then I have refused to remove tonsils without giving four to six weeks of vaccine treatment. A year later I gave the boy five or six weekly injections of vaccine and then removed the other tonsil without the slightest reaction. That is my experience with cases treated since then.

Dr. W. S. Lamb, Washington, D. C.: I suppose the primary object of Dr. McReynolds' operation is to prevent hemorrhage, and I think if the coagulation time of blood were taken in more operations than is now in general practice, the end results would be better for everybody concerned; the surgeon would lose his anxiety and the patient would be absolutely protected against any very serious hemorrhage, because the only other kind of hemorrhage that you can have, and one which is very easily controlled, must be due to the cutting of the superior pharyngeal artery, which, of course, could be controlled.

The other point that struck me as I heard this paper was the question of the end result for the singer. I do not know whether Dr. McReynolds has had experience with this subject or not, but it is an important point, because by removing the tonsils you can sometimes gain two or three notes, and sometimes as many as six notes, in the register of the singer. I do not know whether that would be attained or offset. You might lose as much by the method suggested.

Dr. Harry L. Baum, Denver, Colo.: It seems to me that Dr. McReynolds' conception here (and it is new so far as I am concerned) has a fundamental and very excellent thought for its basis and a very logical reason. It is my understanding that this procedure is not primarily for the control of hemorrhage, as many seem to understand it, and if that were its only object I would be inclined to discard it without giving it a trial as I think the less radical means of controlling hemorrhage will be equally successful. It was my privilege to see Dr. McReynolds perform this operation, and it was my impression that his object was, in a word, to obtain primary union of the tonsillectomy wound without secondary infection and with less resultant scar, the control of hemorrhage being of secondary importance.

The matter of the effect on the voice of singers, of course, is one that is seriously to be considered. None of us can undertake operations on the throats of people of this type without serious consideration of the vocal consequences. It may be that alteration of the structural relationship to which they have been accustomed during years of practice might change their co-ordination sufficiently to interfere with the production of certain tones. However, as Dr. Lamb said, many cases result in an increased range, and an improvement in vocal quality, and I believe the patient must assume responsibility in these cases, whatever method is used. I question whether Dr. McReynolds' method would add to this risk in any way and I can see where it might lessen the con-

tracture and resultant interference with function, and in that way come into favor with those of us who try it.

Dr. H. I. Lillie, Rochester, Minn.: In regard to Dr. McReynolds' technic, I will say that I am very much impressed with it. I do not believe that anyone can foretell the result in the throat after the best tonsillectomy. We have all had the experience of having done what we thought at the time a very nice tonsillectomy with very little trauma, with very well preserved pillars, to see that throat with the pillars coalesced. I think that this is more frequently observed in what I call the high-lying upper pole. Sometimes, however, in the scarring of the throat, patients do have an after-symptom which is rather uncomfortable.

In regard to the removal of tonsils in singers, I think as Dr. Pierce does, when he said that after careful tonsillectomy he has never known a patient with a real voice—of course there are people, who think they have real voices, who have not—to have had the voice injured. It has been my experience with singers that if the plica below is preserved, the resulting scar is less, the contraction at the base of the tongue is less, and the patients are less affected as far as voices are concerned. With regard to the change of register, my observation has been that usually the low register is affected favorably and not unfavorably. So I think in the choosing of any given singer for tonsillectomy, one must not only see the throat, but he must also see that patient, because in choosing that patient it would be uncomfortable for him if he chose the type of patient who would not have a beneficial result no matter how well the operation was performed.

In regard to bleeding after tonsillectomy, I believe that it is dependent upon one thing: The size of the vessels in the particular throat in which you are operating.

Dr. John O. McReynolds (closing): I wish to express my very deep appreciation of the kind reception which this somewhat radical paper has provoked. I have no desire to be dogmatic with reference to this subject.

This is not a perfectly new procedure with me. I am using it invariably in every case and have been now for about two years. In not every case have I carried out completely the idea expressed and which I feel ought to have been carried out.

In taking up in detail the discussion, my friend Dr. Dennis speaks of closing up the pillars of the tonsil fossa and placing gauze in this cavity. I have used that method but it is radically different from one I now employ and it is the very thing that we do not wish to do. It prevents your primary union, and it distends your fossa in such a way as to increase the hemorrhage.

As to the movability of the pillars, I think we have overestimated the physiologic importance of the palatoglossus. The majority of cases sooner or later will lose practically all vestige of anterior pillar. Then, if that is going to be the case, in the majority of cases, why not take advantage of the good features of this anterior pillar and let it cover the wound and diminish your area of granulating surface, which may finally, to some extent at least, be converted into the scar tissue?

Dr. Lamb spoke of the control of hemorrhage and rapid union, and the effect upon the voice of the singer. I have two objects in the operation: The control of all hemorrhage and the promotion of primary union. I have not observed any unfavorable effect on the vocal apparatus.

Dr. Andrews spoke of the bleeding from the pillars themselves. The pillars are not supposed to be disturbed by any modern successful tonsillectomy, I believe. The tonsil is supposed to be removed without interference with the pillars themselves. But if there should be bleeding from the exposed surface of the pillars it would be something that could be immediately controlled.

Dr. Brown spoke of secondary hemorrhage and vaccines. I feel that secondary hemorrhage is something that must be reckoned with wherever the wound is not closed. As to vaccines, I have not felt that there was sufficient necessity for providing against different kinds of infectious diseases to justify the routine employment of vaccines.

Dr. Baum has referred to the end results, which, of course, we all feel can not be sacrificed. We must secure final satisfactory end results.

I feel that rather a large, round Mayo needle is the most satisfactory. The large needle does not produce any more interference with the tissues than a small one. It is only the point that could pierce a blood vessel anyhow, and the tissues immediately close when the needle is passed through. The essential thing is that you use a needle that is not going to break. There is a needle holder which has been useful to me, one which I presented to the Academy of Ophthalmology and Otolaryngology in New York City several years ago. The handle is entirely out of your way and you have an unobstructed field.

Dr. Lillie speaks of tonsils in singers and the mental attitude of those singers. I thoroughly agree with him in that position.

Dr. Bannister spoke of the obliteration of the pockets. The purpose of the operation is really to obliterate the fossa. As stated in the paper, if you use a La Force instrument your dead spaces are all obliterated to begin with, and then your sutures simply complete the work which your La Force instrument had begun.

The question of complete removal is brought out by Dr. Loeb. I first inspect the tonsil that I have removed and see that I have it all, and then inspect the wounded area to see positively that no tonsil tissue remains.

Dr. Loeb also brought up the question of infection. We do not expect to have a perfectly sterile condition of the throat, but we do have just as sterile a condition as you have in your palate operations.

The end results, as brought out by Dr. Thompson, are satisfactory. I do not feel that we have reached the end, but I feel that we are struggling towards the end.

Radium in Diseases of the Ear, Nose and Throat.

By Zdenko Von Dworzak,
Denver.

It is now generally accepted that radium holds a distinctive place in the treatment of neoplasms. In no class of cases is it of greater

value than in the types treated by the otolaryngologist. Radium has a specific action on certain tissues as basal cell epithelioma, sarcoma, angioma and papilloma. The action of radium on any tissue is in proportion to the abundance of nuclei. The more closely the tissue approaches the embryonic type, the more amenable it will be to the radium treatment. Besides the destructive action on neoplasma, I have to mention the palliative properties of radium. I have in mind the relief of distressing symptoms in so-called hopeless cases. Radium relieves pain and controls obnoxious odor and secretions.

Presentation of cases:

1. Epithelial carcinoma, originating in the right side of the throat, invading the larynx, pyriform sinus and the right tonsil. 250 mg. radium, six hours' application at intervals of two days. Case practically cured in six weeks.

2. Scars in throat, the result of an unskilled tonsillectomy. Resorption of scars by application of radium plaque, double strength, unscreened, in sessions of 20 minutes each for two weeks daily.

3. Sarcoma maxillae. Opening of sinus by Denker's method. Cooking of the tumor by soldering iron, insertion of radium tube, 150 mg. for 24 hours. Six months after operation the cavity looks perfectly clear. Patient highly improved.

4. Papilloma laryngis. Tracheotomy was performed, 65 mg. radium inserted between the vocal cords for one hour and 35 minutes. In two months the larynx was perfectly normal. The papilloma of the larynx always responds favorably to radium treatment. In other tumors of the larynx, especially the hemorrhagic form, radium is contraindicated. The results obtained by my original experiments on tubercular conditions of larynx and epiglottis are very encouraging. Only in ulcerative tuberculosis I found a contraindication; lupus is positively benefited.

The neoplasms of the ear, sarcoma, mixosarcoma and epithelioma have to be treated according to their scar.

Since my last publications on the value of radium application in cases of otosclerosis two years passed by, giving me a good deal of new material to work out my theory and put it on more solid basis. I proved on animal experiments that radium absorbs fibrous and bone tissue—both formations found in otosclerosis proper. Further, I found in about 75% of otosclerotics a considerable amount of uric acid present, and I ascribe a great number of changes in the capsule of the inner ear to the irritating action of the uric acid.

I recommend the use of radium combined with the Roentgen ray and the knife. The number of patients cured by radium alone is probably very small relatively, but the number of inoperable cases that are markedly relieved and receive months and years of comfort is quite large. I do not, however, recommend radium treatment of any neoplasm that is surgical.

DISCUSSION.

Dr. Thos. E. Carmody, Denver: My experience has been very similar, but I want to make one exception. The doctor mentioned the brutality in the amputation of the epiglottis. It is almost as

brutal, of course, as taking out a tonsil, so that we should not consider that, because in some of these cases where an epiglottis needs to be removed we remove it because of the great amount of pain that the patient has. Now, whether we can wait for radium to take effect on that is a question. I would be glad if radium would help some of these cases, but at present we do not know that it will.

He spoke, also, of the glands of the neck, in the sarcoma of the antrum, if I understood him correctly, and that would be simply from infection, not metastasis, in that case. I have had two cases that were treated with radium some two years ago, in which there was a great deal of destruction, probably due to the fact that the cases were not screened sufficiently. In one of them the eye was destroyed and the whole of the cheek, and in the other one the eye and a part of the cheek, as well as the palate.

The point that the doctor brought out—of reducing the amount of screening in some of these tumors of the antrum—I think is a very good point, because we get a something out of the tumor and still get the effect of the rays on it. The screening of these cases—of those that I have treated—with simply a millimeter of silver and a millimeter of rubber, sometimes also a millimeter of gauze, has given best results, but as in the epiglottis cases I do not know whether they are cures or not. In some of them we have avoided recurrence.

Now, another point that the doctor brought out, which they are doing in Boston, and especially with the cases of amputation, is that immediately after the operation they are using the radium. We have been taught by many that we should wait for some time until the reaction from either the knife or from the cautery had subsided; but if we introduce the radium immediately after the operation we will get the best results. My experience with radium has been so small that I hesitate to speak of that part of it.

Dr. Gordon B. New, Rochester, Minn.: I believe that anyone who has seen the results of treatment in patients with malignant tumors of the head and neck by operative measures alone, and then has observed a similar group of patients treated by operative measures and radium, will undoubtedly be enthusiastic about the use of radium. The great problem in the treatment of these conditions is co-operation between the surgeon and radiologist. Many patients in whom radium should have been used have had surgical treatment, and many more patients have been treated by radium when surgery should have been employed. I believe that in order to achieve the best results there should be a close co-operation between the surgeon and the radiologist so that the surgeon will not operate just because the patient comes to him for examination, nor will the radiologist employ radium therapy merely because he sees the patient first. The patient should be given the treatment best suited to his particular case after a careful consultation with all those who are familiar with the pathologic condition. I believe this is well brought out by results at the Mayo Clinic in the treatment of such cases as nasopharyngeal malignancies, malignant tumors of the antrum, multiple papilloma of the larynx, and so forth.

**A Valuable Method Not Mentioned in Text Books for Treating
Peritonsillitis.**

By W. R. Thompson, M. D.,
Fort Worth, Texas.

Dr. Thompson, in brief, advocates early deep incision into the infected area around the tonsil, and the insertion of an especially constructed, self-retaining, drainage tube of small caliber into the wound. This tube is made of ordinary red rubber tubing with several turns of narrow adhesive tape taken around the end to form a shoulder and act as a retaining mechanism in the wound. The tube is cut in lengths of about one and one-quarter inches and is inserted small end first into the depths of the wound so that it is completely submerged, the end coming just flush with the surface of the mucous membrane. This procedure is instituted as soon as the diagnosis of peritonsillitis is made, not waiting for formation of pus, and in the experience of Dr. Thompson has given very remarkable results in almost complete relief from suffering in the comparatively large series of cases in which it has been tried.

DISCUSSION.

Dr. Wm. C. Bane, Denver. When something new is brought to our attention that is of real value we are indebted to the physician who brings it.

Dr. Thompson has devised a surgical method for early drainage of a developing peritonsillar abscess by inserting a rubber drainage tube where depletion is most needed. His large experience and satisfactory results should stimulate us to thoroughly test out his method. Unfortunately, a large percentage of the patients with developing peritonsillar abscess do not apply for relief in the formative stage when depletion might abort the abscess. In perhaps ninety per cent of the cases, according to St. Clair Thompson, the abscess points above and anterior to the tonsil so that early insertion of the drainage tube will, in nearly all cases, bring about the desired depletion. For a good many years I have advocated and practiced the St. Clair Thompson method of opening a peritonsillar abscess. The opening is made with angular forceps like the Hartmann nasal dressing forceps. (Forceps exhibited.)

If an imaginary horizontal line be drawn through the base of the uvula, and a vertical line along the anterior pillar, they will intersect above the tonsil. The point for entrance with the forceps is one centimeter external to the meeting of these two lines. The closed end of the forceps is thrust backward and outward until the abscess is entered when the blades are spread and withdrawn, giving vent to the pus, and producing ample opening for drainage.

Dr. John Robinson, Colorado Springs: I would like explained just how Dr. Thompson makes his diagnoses between the ordinary tonsillitis and peritonsillitis so as to early determine his time of drainage.

Dr. Frank Albert Burton, San Diego, Cal.: I want to personally thank Dr. Thompson for calling our attention to this surgical intervention which has given such satisfaction in his practice. All laryngologists, from time to time, have to deal with peritonsillar

abscesses which do not respond well to the usual surgical procedure. I have had a few such cases during the past year or so in which I have felt justified in following the advice of a certain laryngologist, whose name I do not recall, and removed the tonsil. This procedure does not especially appeal to me, but in each case the result was most satisfactory. I believe Dr. Thompson's method, in such cases, would be worth while. Following the operation in these cases, and in fact, as part of the postoperative treatment of all adult tonsillectomies, I have my patient use an aspirin gargle, dissolving five to ten grains of aspirin in a half glass of water as often as desired but regularly five minutes before each nourishment. This makes eating less uncomfortable, with the natural result that the patient loses less weight and strength.

Dr. Thos. E. Carmody, Denver: Dr. Bane brought out one point that I feel ought to be enlarged upon a little, and that is you practically always find your abscess in the supertonsillar fossa. You can drain those situated below by putting a forceps into them, slipping it under the anterior pillar with practically no trouble.

Another point which Dr. Thompson also mentioned—that most of these cases do not come to us until they are pretty well advanced, but the same thing applies. For a number of years I have been using forceps, but I have used a long pair of hemostatic forceps, after the method published by Pierce, of simply going into the abscess behind the pillars or under the plica and getting drainage. That is the natural point of drainage, and it is the damming of superior crypt that causes your supertonsillar abscess, which it should be called instead of peritonsillar as it practically always drains down. Dr. Thompson gets the same result because he is simply bringing it by the aid of gravity down along the posterior portion of the anterior pillar. The method brought out by Dr. Burton of simply removing the tonsil where you have an abscess I have not tried, although I have talked with a number of men who have, but it has happened that most of the cases that I have seen I have been able to drain in this other way. It had advanced so far and the abscess was so large that it really had broken through.

The method of Dr. Bane of putting forceps through the pillar is good, and unless it causes too much inconvenience to the patient, should be a little bit larger. It is a fact that the patient will not stand too large forceps. I can understand that because I have had an abscess myself.

Dr. Henry L. Baum, Denver: It occurs to me that Dr. Thompson's method certainly has a great deal to recommend it. It has been my experience in these cases that my patients have to endure from one to three days of suffering before I can give them relief, when they consult me early in the disease. In other words, relief can be given only by incision after pus has formed, opening the infiltrated tissues previous to breaking down having so far been unproductive of good results in my own experience. Incision is, of course, of immediate value in the late cases, but it is not this class of cases that Dr. Thompson is dealing with, and I feel that he has given us something which seems to me original and is certainly worth a trial. If it is as successful in my hands as it has been in his, I shall never cease to thank him for having helped

me out of a very unpleasant experience in every case of this sort with which I come in contact.

It appeals to me that drainage through this small opening is probably incomplete, because my experience with drainage tubes has been that if they are not very large they do not drain very well. Fibrin quickly forms from these secretions when in contact with a foreign substance, and would no doubt soon obstruct the tube, hence it may be that the drainage around the tube is more important than that through it.

Dr. Frank R. Spencer, Boulder: If I remember rightly, the late Dr. W. L. Ballenger advocated elevating the anterior pillar in order to get better drainage, and simply dissected the anterior pillar very much as you do in the beginning of a tonsillectomy. That method has been very painful, and evidently has not proven satisfactory. I have been an advocate of the method Dr. Bane mentioned of using a pair of forceps. I originally used either a tonsil knife or a sharp bistoury, but there are a few cases in which severe hemorrhage has followed the use of any sharp instrument. A pair of forceps will not cut, and you can spread them. Any method of opening a peritonsillar abscess is apt to be extremely painful.

Dr. John O. McReynolds, Dallas, Texas: I had the pleasure of hearing Dr. Thompson's original presentation of this subject at Houston last April, and I simply rise to say that I am convinced that the procedure has a very distinct degree of merit. I think there are two avenues through which you may reach the peritonsillar area successfully and then insert this tube as Dr. Thompson recommends. You can either introduce it through the anterior pillar, or you could introduce it in that space between the tonsil and the anterior pillar by simply opening up that channel as suggested by Dr. Bane with artery forceps and introducing it in that way into the peritonsillar abscess.

The Three-Fold Manifestations of Fifth Nerve Disturbances.

By B. F. Andrews, M. D.
Chicago, Ill.

The trifacial nerve is important to those who limit their practice to the eye, ear, nose and throat, not only because of its distribution and function, but because of its interrelation to these organs, to the general system, and also the variety of its reactions to disturbing stimuli. It is the great sensory nerve of the head. It supplies every cavity in the head, including the cranial, and its meninges, with sense carrying fibers. Sensations in the orbit are made manifest through this nerve. The nasal mucosa and that lining the paranasal sinuses, namely, the frontal, the ethmoid, the sphenoid, and the maxillary, derive their sensory filaments from the same nerve.

After detailing the anatomy of the trifacial nerve and mentioning the connections it formed with all the motor nerves of the eye, the author states that irritations of the fifth nerve manifest themselves in disturbances of sensation, increased muscular activity and vasomotor changes.

As familiar examples of sensory disturbances, he mentions headache due to eyestrain or fatigue; earache due to irritations around

the roots of teeth, or associated with tonsillectomies; tender scalp during a severe cold in the head; neuralgia and headaches of nasal origin, made worse during seasons of inclement weather, etc.

Familiar examples of motor manifestations are not so numerous as those of sensory.

After discussing the vasomotor manifestations resulting from peripheral irritations, the author refers to the retrograde changes which take place following active disturbances of the sympathetic.

There are three stages in long continued inflammatory processes: First, hyperemic, or the vessel dilatation stages. Second, hypertrophic or tissue overfeeding stage. Third, the atrophic or tissue contraction and starvation stage. Atrophies, whether in the nose, Eustachian tube, or ear, should be looked upon as end-products of fifth nerve disturbance. May there not be some causal relation between such disturbances and otosclerosis, or between them and intractable corneal ulcers?

DISCUSSION.

Dr. Edward J. Brown, Minneapolis, Minn.: I have found that injecting the ganglion is not always an easy thing to do. I have been able to give temporary good results by injecting the peripheral branches. I think Dr. Andrews is right in his statement that if we carefully examine our cases and make a diagnosis of conditions, we will eliminate many of the cases that seem to require operation.

I remember one man of 80 years whom I relieved for some years by washing out his antrum. Later he went to Dr. Ball of St. Paul and was given further years of relief by an injection of the nerves. Still later, he returned to me with the same old trouble, and I was able to relieve him again by washing the antrum.

Observations on the Management of Tuborrhoea. ...Report of a Series of Twenty-five Cases.

By H. I. Lillie, M. D.,
Rochester, Minn.

The nose blowing habit is an important etiologic factor in all cases of suppurative otitis media. In the tuborrhoea type of otitis media the nose blowing habit may be the causal factor of the continuance of the discharge. The usual manner in which a patient blows the nose is closing off the unobstructed side and forcibly clearing the obstructed side. The increased nasopharyngeal pressure causes the tube to be opened and the diseased ear, having lost the protection of an intact membrum tympanum and the air pad within the ear, is filled with nasal secretions. Sneezing is the normal manner of clearing the nose, and during the process both sides are freed. When obstructions are present in the anterior nares, whether anatomic, physiologic, or, particularly, a combination of both, there is added danger of increased unilateral nasopharyngeal pressure and of blowing secretions into the tube and middle ear.

In studying twenty-six cases in the Mayo Clinic of tuborrhoea in adults who complained of the discharge more than the discomfort,

it was found that in fifteen, 57.69 per cent, the obstruction was combined anatomic and physiologic. Eight patients, 30.76 per cent, had no further trouble after they had learned to blow the nose with both nostrils open. No other treatment was used. No patient of this group had any demonstrable suppurative process in the nose and throat. Six patients had been advised elsewhere to undergo the radical mastoid operation. All six responded to our conservative treatment in a few days, and there was obviously no need for radical procedures. Thirteen patients had operations on the septum. In the local treatment of the ear all lavage was avoided, and the ear cleaned by means of suction or mechanically with cotton application. Two patients improved under the Yankaur tube procedure.

Conclusions from this study of cases are that: (1) Tuborrhea is frequently the result of incorrectly blowing the nose; (2) pathologic conditions other than suppurative processes, particularly anterior nasal obstructions in adult patients, are indirect causative factors of the condition, and (3) clinical classification of suppurative processes within the middle ear should be more exact.

DISCUSSION.

Dr. William E. Callfas, Omaha, Neb. (opening): I want to relate a little experience of Dr. Jos. Beck in connection with trichloroacetic acid. He conceived the idea from Dr. Harold Gifford, who uses trichloroacetic acid to obliterate the tear sac. Dr. Beck thought this might be used to obliterate the Eustachian tube, but he had a facial paralysis following the use of the trichloroacetic acid. The facial nerve was probably exposed. I think, however, that trichloroacetic acid can be used if care is taken not to have the applicator swab too moist.

Dr. Edward J. Brown, Minneapolis, Minn.: In a case of double tuborrhea I introduced through both tubes by means of a catheter, a wire with a tip wound with cotton and soaked with strong carbolic acid. One ear has been perfectly well during the past five years. The other was well until a few weeks ago when the man returned for a few days' treatment.

Dr. Lillie (closing): The point I wanted to make particularly in this paper was that the mere correction of the nose blowing habit in about twenty-five per cent of this type of tuborrhea will correct the tuborrhea without any management of the tube itself. This group, which I have talked about, has been the chronic type in adult patients. In cases of small perforations, attempts are made to close them by whatever means we can.

The group is interesting. We have seen a large number since the preparation of this paper, and it is greatly increasing. More careful clinical classification of suppurative diseases of the middle ear and appendages is to be desired.

Primary Sarcoma of the Middle Ear.

By Wm. F. Callfas, M. D.,
Omaha, Neb.

Forty-one cases of sarcoma of the ear have been reported but sections were made in only thirty. In eleven more none were

made. Also in the cases reported the origin was not in the middle ear in all cases, or at least was doubtful. Of the forty-one cases reported, the tumor was primarily in the tympanic cavity in twenty-four cases, as nearly as could be ascertained. In all the forty-one cases there was more or less involvement of the middle ear. Of all the cases reported, where diagnosis of sarcoma by sections were made, seventeen were probably primary in the middle ear.

Clinically, the cases seem to fall in two distinct groups. First, rapid growing, very malignant, occurring in children, and are always fatal, which run their course in from a few weeks to a year. In this group of forty-one cases, twenty-one occurred in persons below the age of twenty, eleven at the age of forty or over. In children and young adults operative interference seemed to increase the rapidity of the growth, while in the cases after the age of forty, the course seemed to be retarded by the operation. The clinical pictures were variable.

Deafness was almost universal. Pain in varying degrees in nearly all cases. Polypi or some external growth presented in the canal in twenty-six cases. Discharge from the ear in twenty cases. The irritative discharge was the only hint of etiology given in any case except a few of the juvenile cases, where symptoms dated from traumatism. Hemorrhage from the ear occurred in ten cases. Facial paralysis in seventeen.

Treatment: This was operative in nearly all cases. Radical operation was done in twelve cases. Simple removal of polypi one or more times, in ten cases. Only one case treated by X-ray was without effect in delaying the fatal outcome. There are only three cases reported where a cure can probably be claimed. Only one case recorded was treated by radium, but the pathologist diagnosed it as a malignant growth, not specifying whether sarcomatous or carcinomatous. The patient was given twelve applications of radium of from twenty to thirty minutes' duration over a period of one year. The growth had decreased in size, and the treatment was being continued at the time of this report.

Within the past four years I have had two cases of primary sarcoma of the middle ear.

Case 1. Date, October, 1916; made, age 33; occupation, farmer. Had discharging ear for two years, followed by pain and loss of hearing. A growth filled the middle ear, which bled freely. A portion of this growth, removed and sectioned, proved to be spindle-celled sarcoma. The middle ear and adjacent canal were thoroughly curetted and followed by radium treatment. Patient was given two treatments, 32 mg. of radium, time two hours, and in February of the following year 16 mg. of radium was used, time two hours. Patient has returned several times for examination, has improved in health and gained in weight. Up to the present time there is no sign of a return of the growth.

Case 2. Date, October, 1919; female, aged 32; housewife. Had right ear trouble when nine years old. Had much pain, followed by discharge which lasted only a few days. This was followed by right facial paralysis, which has existed for twenty-three years. When first seen, at the office, in October, 1919, she had severe pain in and around the right ear, was losing weight, and was able to

walk only by assistance. A bluish mass filled the middle ear. An operation was performed much the same as for a radical mastoid. The middle ear was thoroughly curetted; the mass extended into the petrous portion of the temporal bone. When this was curetted and completely removed, the wall was perfectly smooth, and the internal carotid artery exposed at the bottom of the canal. A microscopic examination of the removed mass proved to be fibrosarcoma. A tube of radium was inserted on September 24, 1919; 32 mg. of radium, time nine hours. September 25, 1919, 32 mg. of radium, time eight and one-half hours. Patient has returned several times for observation and was given one more treatment of radium. Following the operation and radium, she was free from pain for about one week. At about this time she suffered from a radium burn. This lasted for several weeks. She is now free from pain, has gained in weight, and is doing her housework.

While it may be too soon to say what the final outcome will be in these two cases, I think this much can at least be said, that the radium treatment has given the patients comfort and a new lease on life, if not a permanent cure.

DISCUSSION.

Dr. Callfas (closing): In regard to Dr. Loeb's remarks, we never depend upon the clinical findings. We want to at least make sure, if we can, and we always have microscopic examinations made by a reliable man. The pathologist of the University is a man of a great deal of experience, and when he gives a report of carcinoma we can usually bank on it. Of course, we combine our clinical findings in each of these cases.

If there is some way of eliminating this pain following radium, I would like to know it. We have had a number of cases where the pain after the radium treatment was very severe, and if there is some way of avoiding that, I would be very glad to know of it.

The Relation of the Eye to the Ear, Nose and Throat.

By Hanau W. Loeb, M. D., and Meyer Wiener, M. D.

St. Louis, Mo.

The writers announce that their experience and a careful survey of the literature force upon them the following conclusions:

1. Lesions of the eye and its adnexa occur far more frequently from pathologic processes involving the nose and paranasal sinuses than is generally accepted.

2. A study of the minor processes would result in a more fruitful yield, than that which has followed the interest in the exceptional and striking cases manifested up to the present time.

3. It is necessary to examine and to study in detail the nose and paranasal sinuses in all eye conditions for which they may be responsible, including conjunctivitis, lacrimal sac conditions, orbital cellulitis and abscess, corneal ulceration, iritis and its associates, maturing cataract, retinal hemorrhage, retinal detachment, optic neuritis, ocular and retrobulbar, optic atrophy, glaucoma, reduction of vision, diminution of the field and functional disturbances not otherwise explained.

4. It is most important to examine for and to record any change in the orbital or ocular tissues in all cases of acute or chronic suppurative processes involving the paranasal sinuses.

5. Persistent and intelligent study along these lines must bring about a solution of many of the vexing problems that have been uncovered by the casual study of the relation between the eye and the upper respiratory tract.

DISCUSSION.

Dr. Frank R. Spencer, Boulder, Colo. (opening): Mr. Chairman and members: I have been deeply impressed by all that Dr. Loeb has said. He has covered the subject during the past few years in the very thorough manner. In the practice of ophthalmology we are anxious to know what percentage of these cases might have been attributed to sinus diseases which may have existed in childhood and maybe in adult life. At otolaryngologists we are anxious to do all we can to cure these cases. Dean's work on sinuses during the past few years, as well as that of Onodi and others, is yielding very gratifying results and shows that sinus diseases are much more prevalent in children than we had formerly thought. Doubtless we will find that more of the eye diseases in children are due to nasal disease than we had formerly thought.

Gradle's work, and also Peter's, in measuring the blind spot, as Dr. Loeb has intimated is of great value. The work can be done, of course, with a Bjerrum screen, but we prefer to use Peter's campimeter because it is easier of manipulation. We have been especially interested in watching cases of hyperplastic ethmoiditis and sphenoiditis because we see so many of these cases and the effect upon the eyes. I agree absolutely with Dr. Loeb when he says that a nasal examination is necessary in any case of eye pathology, because without such an examination you are not doing your best for the patient.

An X-ray examination of the nasal accessory sinuses in hyperplastic disease is sometimes disappointing, because there is very little or nothing which can be demonstrated in the radiogram. I am reminded in this connection of what Dr. Sweet of Philadelphia said regarding penetrating rays in searching for very small foreign bodies in the eye. He states that if the X-rays are too penetrating, the small particle of steel, copper or lead will sometimes not show on the film. That is sometimes a surprise because we do not expect a small white patch of exudate to cast a shadow, but we do expect a metallic foreign body to cast a shadow.

Now, probably in cases of hyperplastic disease of the sinuses—and this is the point I want to bring out—the rays may be too penetrating and we do not get the best results from the X-ray examination. Of course, we know there is rarefaction of bone in cases of hyperplasia, so that less penetrating rays might show the pathology.

I have also been interested in watching the cases which Sluder has designated as lower half headache, and which has its beginning in the sphenopalatine ganglion. Sometimes we see the congestion in the region of the ganglion of the sympathetic, and the

eye can be relieved either by the proper nasal treatment or by surgery of the nose.

Dr. Melville Black, Denver: It seems to me the accepted position should be that when a patient is going blind from a postoptic neuritis, and no cause can be found, that the posterior ethmoid and sphenoid cells should be opened and dealt with according to the indications at the time of the operation. Other possible causes, such as focal infections from teeth, tonsils, etc., should not be neglected by any means, but they should not be followed too long to the neglect of a possible nasal sinus causation.

Dr. H. L. Lillie, Rochester, Minn.: I think that the intranasal method of drainage of well-chosen cases of dacryocystitis is a well-directed procedure. It is easily accomplished and gives good results. However, I am one of those who feels that we must not believe all dacryocystitis is due to an ethmoid involvement. The work of Shaffer is particularly comprehensive in the anatomic consideration of the sac and the ducts. I believe that the dacryocystitis may set up an involvement of the adjacent ethmoid secondarily. My experience in operating these nasal conditions has been that the involvement of the ethmoid is usually more adjacent to the sac, so it would take a great deal to prove to me that a small area of the involvement of the ethmoid immediately adjacent to the sac could secondarily involve that sac. It seems more reasonable for me to believe that the involvement comes from the dacryocystitis, in those cases not showing a frank ethmoiditis.

Dr. McReynolds, Dallas, Tex.: We had hoped that the X-ray would do something that would enable us to say, "Here we have a distinct lesion and here we have not," but as brought out here, the X-ray does not always show even definite foreign bodies within these cavities, or within the eye.

At the Atlantic City meeting of the American Medical Association I reported a number of foreign bodies within the eye so small that the X-ray positively would not show them, and yet they could be seen with the ophthalmoscope and were removed.

Dr. Edward J. Brown, Minneapolis, Minn.: I take pride in the fact that some thirty years ago I read before one of our local medical societies a paper in which I made the claim that a great deal of eye trouble came from nasal conditions. About that time a very remarkable paper was published, I think by Ziem, showing that much disease of the eye came from nasal diseases and especially from infected sinuses.

Dr. William L. Benedict, Rochester, Minn.: I think that every few years the subject of relation of the eye to the ear, nose and throat should be well reviewed. It has not been very long since in my own internship, we made a careful search through our records and of the cases that were passing through our hands at the University of Michigan, of the eye conditions which could definitely be traced to disease about the nose and throat. We concluded from a review of our cases that there were very few eye conditions that were due to the trouble in the nose and throat.

A recent work by Schaeffer of Philadelphia, on "The Nose and the Olfactory Organ," has brought out the importance of paranasal sinus diseases in relation to dacryocystitis. The fact that

we have so much purulent discharge from infected lacrymal sacs which keeps up in spite of more or less adequate drainage and treatment, has led us to believe that the ethmoids were involved more frequently than we had thought for, and since adopting the intranasal method of treating dacryocystitis we have discovered cases of ethmoiditis which had not been discovered by previous examination.

In reference to the question of whether choked disc follows disease of the sinus, personally I believe it does not, and I say that in spite of the fact that case reports do not seem to bear us out in that respect.

I think our greatest difficulty lies in choked disc. I agree perfectly with Dr. Wiener that we have borderline cases difficult to diagnose, and we must know that with choked disc we may have neuritis as a result of the choked disc. However, there are certain features accompanying inflammation which do not accompany papillitis or edema of the nerve. If the inflammation should occur with its features strongly brought out, there would be no reason for confusing the two, but the more carefully one examines for the well-known evidences of the inflammation, the more often will he make the distinction. I feel sure that anyone who looks at the optic nerve as carefully as he looks at the sections under the microscope will be able to differentiate choked disc and optic neuritis.

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